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PHYSICS ABSTRACTS

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SECTION A OF SCIENCE ABSTRACTS

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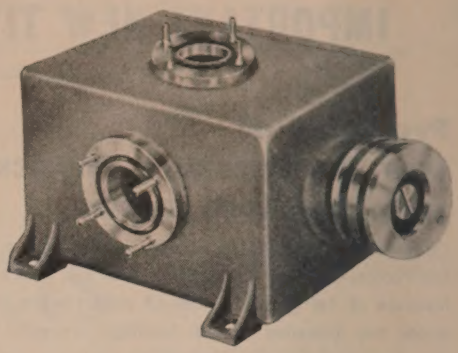

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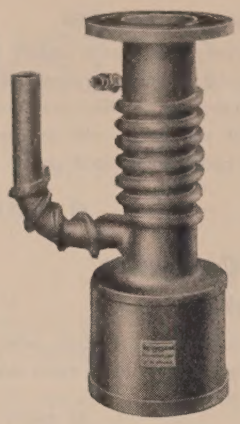

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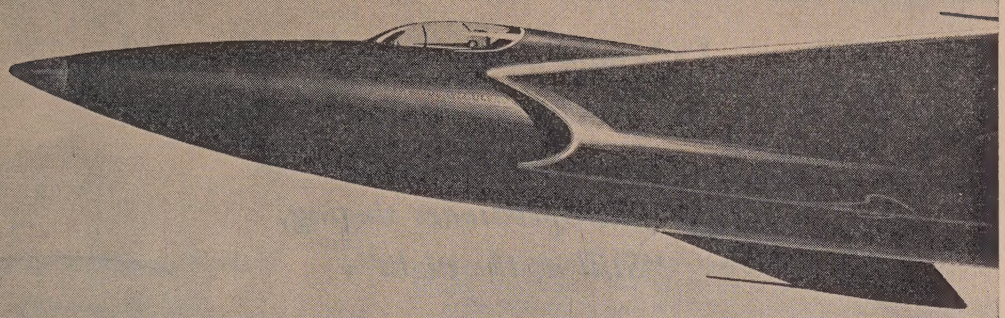

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PHYSICS ABSTRACTS

Volume 62 NOVEMBER 1959 Number 743

MATHEMATICS

512.14

11706. NOTE ON "DOUBLE BINOMIAL COEFFICIENTS". H.Izbicki.
Nuclear Phys., Vol. 12, No. 5, 532 (Aug. (2), 1959).

Shows that the double binomial coefficients used by Ford and Konopinski (Abstr. 2648 of 1959) can be expressed in terms of the ordinary binomial coefficients.

517.2 : 530.145

11707. REPRESENTATION OF THE M OPERATOR OF FREISTADT AND STRUIK. R.Bourret.
Amer. J. Phys., Vol. 27, No. 6, 430 (Sept., 1959).
See Abstr. 977 (1959).

517.6 : 539.19

TABLE OF LIGAND FIELD INTEGRALS. See Abstr. 11524

517.9 : 530.162

11708. THE SOLUTION OF EQUATIONS BY THE METHOD OF PERTURBATIONS. M.Fabre de la Ripelle.
Ann. Phys. (Paris), Vol. 3, No. 7-8, 510-68 (July-Aug., 1958). In French.

The author seeks to find a method of solution of equations of motion of physical systems for various parameters. Dirac's method of perturbations is used. The properties of the methods of solution proposed are discussed in a general manner. There are no examples of numerical applications. N.L.Johnson

518.5 : 621.317.79

11709. USE OF LAGUERRE FILTERS FOR REALISATION OF TIME FUNCTIONS AND DELAY.
A.K.Choudhury and N.B.Chakrabarti.
Indian J. Phys., Vol. 32, No. 5, 205-11 (May, 1958).

A method is given of realizing time functions, delays and delayed integrations by making use of Laguerre filters. Circuits for realizing two classes of Laguerre functions are described. The method has the merit of easy adjustment for obtaining different operations.

518.5 : 535.8

11710. OPTICAL ANALOG COMPUTERS. B.J.Howell.
J. Opt. Soc. Amer., Vol. 49, No. 10, 1012-21 (Oct., 1959).

Certain applications of optical devices in digital computers are described, and a general theory of optical analogue computers is developed. Certain characteristics of the photographic process make it possible to perform mathematical operations with photosensitive materials, as well as with photocells. These characteristics are: (1) the modulation of light intensities by optically dense films; (2) the addition of densities of superimposed layers; (3) the multiplication of transparencies of superimposed layers; (4) the ability of the photographic emulsion to integrate exposures occurring throughout time or from several sources. Examples of optical methods of calculation are described, and the construction of an optical analogue computer for synthesizing the two-dimensional Fourier transform of a function for use in crystal structure determination is described. A new machine giving immediate presentation of the results of two-dimensional Fourier transforms is proposed.

519.2

11711. TABLES OF THE BIVARIATE NORMAL DISTRIBUTION FUNCTION AND RELATED FUNCTIONS.
Appl. Math. Ser. Nat. Bur. Stand., No. 50, xlv + 258 pp. (1959).

519.2 : 621.391 : 621.373.44

11712. ELECTRONIC PROBABILITY GENERATOR. G.M.White.
Rev. sci. Instrum., Vol. 30, No. 9, 825-9 (Sept., 1959).

The investigation of nonstationary random processes arises in many models of control and learning systems. To aid in studying this class of systems, an electronic probability generator, E.P.I. was built. E.P.I. can electronically "flip" a coin at a maximum rate of 500 times/sec. The probability of heads of this electronic coin can be varied from 0 to 1 and is a linear function of the input voltage. Graphs are presented to illustrate E.P.I.'s ability to generate independent events. E.P.I. can also be used to generate sequences of heads and tails controlled by higher order probabili The only additional equipment required is an electronic switch.

ASTROPHYSICS

521.1

11713. INVESTIGATIONS ON THE CONDITIONS OF EXISTENCE OF PERIODIC SOLUTIONS OF THE THIRD KIND OF THE THREE-BODY PROBLEM. J.Grémillard.
Bull. astron. (Paris), Vol. 22, No. 3, 221-42 (1959). In French.

Summarizes and develops part of Poincaré's "Les Methodes Nouvelles de la Mécanique Céleste" devoted to solutions of the third kind. (Eccentricities small but not inclinations). Chapter I recalls some of the main results of the theory of periodic solutions of a differential system and their application to the equations of dynamics. Chapter II establishes, in a suitable canonical form, the differential system governing the 3-body problem. A small parameter ϵ is introduced, in powers of which the generating function is developed. G.A.Chisnall

521.1

11714. INVESTIGATIONS ON THE CONDITIONS OF EXISTENCE OF PERIODIC SOLUTIONS OF THE THIRD KIND OF THE THREE-BODY PROBLEM. J.Grémillard.
Bull. astron. (Paris), Vol. 22, No. 4, 243-332 (1959). In French.

See preceding abstract. Such solutions exist if the mean motions of the two planetary bodies are commensurables with each other, i.e. their ratio is equal to the quotient of two relatively prime integers p and q. When the mutual inclination of the osculating orbits is small (case I), the method used for the discussion is independent of the parity of $p - q$; but if the inclination takes an arbitrary value between 0° and 180° (case II), the discussion is dependent on whether $p - q$ is even or odd. Periodic solutions exist only for some special initial values of the osculating elements of the two orbits (or of some connected variables). The last four chapters develop and explain in detail a paper by von Zeipel (1904). It is shown that von Zeipel's equations can be deduced from those of Poincaré. The conditions of existence are given completely for case I. In case II, solutions of the third kind exist when $p - q$ is even whenever the initial eccentricities are zero, and in certain other cases. If $p - q$ is odd and greater than or equal to 3, no such solutions exist other than for the two limiting cases of 0° and 180°. G.A.Chisnall

522.61

11715. THE INTERFERENCE FILTER AT THE ASTROPHYSICAL OBSERVATORY AT ARCETRI. M.Rigutti.
Ricerca sci., Vol. 29, No. 6, 1159-72 (June, 1959). In Italian.

Describes a new 10 layer interference filter for solar observations in H α. The photographic and visual equipment for use with the filter is also described. A new method is outlined for the direct visual estimation of the area of chromospheric phenomena.

R.W.Fish

523.11

11716. OBSERVABLE RELATIONS IN RELATIVISTIC COSMOLOGY. III. P.S.Florides and W.H.McCrea.
Z. Astrophys., Vol. 48, No. 1, 52-71 (1959).

For previous parts, see Abstr. 1480 (1935) and 2394 (1939). A well-formulated observational criterion is sought for the property that an evolving expanding universe must appear to be more congested at great distances than it is in the cosmical neighbourhood of the observer, while a steady-state universe ought to exhibit the same congestion at all distances. The ratio of a statistical measure of the angular separation between objects (such as clusters of galaxies) and suitably specified neighbours in the sky to a statistical measure of the angular diameter of the objects themselves is considered. If z is the spectral red-shift of these objects, it is shown that, with an unexpected degree of generality, the ratio would be proportional to $(1 + z)^{-1}$ in an evolving universe; it would be independent of z in a steady-state universe. The feasibility of applying this criterion to the actual universe is discussed. Some related questions concerning the smoothed-out representation of the universe are briefly considered. The problem of relativistic apparent size is further discussed for the sake of its intrinsic interest.

523.14

11717. THE KINETIC TEMPERATURE OF AN ATMOSPHERE SUPPORTED BY RADIATION. I. A.H.Davis.
Astrophys. J., Vol. 125, No. 3, 771-87 (May, 1957).

The anisotropy of the kinetic temperature of a tenuous atmosphere in an anisotropic radiation field has been investigated under the assumption that the interaction between matter and radiation is restricted to absorption and emission of a single resonance line and that interatomic collisions are of negligible importance. The method used here is similar to one used by Langevin. The results obtained are in qualitative agreement with those of Milne, although some significant terms arise which did not turn up in the earlier work. Numerical calculations are presented to show the extent of the anisotropy and its variation with the frequency of the resonance line and with the character of the radiation field. Estimates are made of the conditions under which the theory might be expected to apply to an actual stellar atmosphere.

523.14

11718. THE KINETIC TEMPERATURE OF AN ATMOSPHERE SUPPORTED BY RADIATION. II. A.H.Davis.
Astrophys. J., Vol. 127, No. 1, 118-24 (Jan., 1958).

The anisotropy of the kinetic temperature of a tenuous atmosphere in an anisotropic radiation field is investigated. The atmosphere is supposed to consist of small particles capable of continuous absorption and emission and assumed to be in pseudo-thermostatic equilibrium. Interparticle collisions are assumed to be of negligible importance. A numerical evaluation of the anisotropy is given for the case of an atmosphere above a surface radiating as a black body.

523.152.2

11719. GAS–DUST INTERACTION IN THE ACCRETION OF INTERSTELLAR DUST BY THE SUN. C.B.Stephenson.
Astrophys. J., Vol. 126, No. 1, 195-201 (July, 1957).

The suggestion that the sun's family of comets was acquired by accretion of dust from the interstellar medium encounters a difficulty in the form of the interaction between dust and radiation pressure. If the general nature of the dust is correctly characterized by current views, the solar radiation pressure upon a particle exceeds the gravitational force for a large fraction of the total population of particles. Hence it is of interest to investigate the possibility that the dust can nevertheless be accreted through interaction with the interstellar gas. Approximate calculations have been made to ascertain the behaviour of dust particles of the order of 10^{-5} cm in diameter, for which $\rho \cong 1.0$, in the radiation field of the sun and subject ot viscosity effects in the interstellar gas. It is concluded that interaction between gas and such dust particles cannot compensate for the influence of radiation pressure for a gas density in the unperturbed cloud $\leq 10^4$ atoms/cm^3 and for relative velocities of the order of 5 km/sec between star and cloud. Much lower velocities favour dust capture more than do the velocities discussed here, but they involve excessive accretion of gas by the sun.

523.16 : 532.5 : 538.

PROPAGATION OF MAGNETOHYDRODYNAMIC WAVES IN COSMIC CONDITIONS. See Abstr. 11271

523.161 : 551.510.53

SPORADIC E-REGION IONIZATION, "SPREAD-F", AND THE TWINKLING OF RADIO STARS. See Abstr. 11650

523.16

11720. COLD INTERSTELLAR GAS AND LIGHT ABSORPTION. V.I.Krasovskii.
Astron. Zh., Vol. 35, No. 6, 825-8 (1958). In Russian.

It is shown that in a cold interstellar gas envelopes of neutral molecules form around the ions. On these envelopes an intense process of recombination of atoms into molecules and the formatio of negative ions take place. It is shown that the concentration of negative ions, especially of molecular oxygen, can be high enough for explaining the observed light absorption. Various properties o screened ions are discussed and the possibility of explaining interstellar polarization of stellar radiation by negative ions is indicate

523.16

11721. TECHNICAL AND ASTRONOMICAL MEASUREMENTS WITH THE BONN 25 METRE RADIOTELESCOPE. I - II. P.G.Mezger.
Telefunken Ztg, Vol. 31, 213-25 (Dec., 1958); Vol. 32, 38-46 (Marc 1959). In German.

The alt-azimuth telescope of the Bonn University Observatory was designed to operate at the hydrogen-line frequency of 1420 Mc The receiver employs switching between two frequencies in the fir local oscillator and maintains a baseline drift of less than 1°K ove 2.3 Mc/s. When used as a continuum receiver the stability is better than 1°K per hour. The beamwidth of the aerial at half pow points is 41' and 32½' in the E- and H-planes, respectively. The collecting efficiency of the aerial aperture is 53.5%. The refractic extinction, and emission introduced by the earth's atmosphere at a frequency of 1420 Mc/s were determined. Radiation from the earth and a number of radio sources was measured; the moon sho a brightness temperature of 250°K. Spectra taken of the radiation from interstellar neutral hydrogen exhibited more structure at a bandwidth of 15 kc/s than at 30 kc/s. Line radiation from the Andromeda Nebula was also detected. R.D.Davi

523.164 : 551.521.2 : 621.396.8

11722. THERMAL RADIATION OF THE GROUND AND THE ATMOSPHERE AT 1420 Mc/s, AND ITS EFFECT ON AERIAL NOISE. P.G.Mezger.
Z. angew. Phys., Vol. 11, No. 2, 41-6 (Feb., 1959). In German.

The observation of thermal radiation from the earth's surface and atmosphere at 1420 Mc/s is considered and the possibility of making a radio map of the earth's surface utilizing a maser at thi frequency is suggested. H.J.A.Chive

523.1

11723. THERMAL RADIO WAVES FROM THE MOON AT 1420 Mc/s. P.G.Mezger and H.Strassl.
Z. Astrophys., Vol. 48, No. 1, 72-6 (1959). In German.

Observations were made over three lunar cycles of the therm radiation from the moon at 1420 Mc/s. It was found that a signifi cant contribution comes from beneath the lunar surface, and the mean temperature was calculated to be about 250°K.

H.J.A.Chive

523.164 : 551.510.5

REFRACTION OF EXTRA-TERRESTRIAL RADIO WAVES IN THE IONOSPHERE. See Abstr. 11651

523.164.

11724. THE 1954 ECLIPSE MEASUREMENT OF THE 8.6 mm SOLAR BRIGHTNESS DISTRIBUTION.
R.J.Coates, J.E.Gibson and J.P.Hagen.
Astrophys. J., Vol. 128, No. 2, 406-15 (Sept., 1958).

The solar eclipse of 30 June, 1954 was observed from a site Sweden near the eclipse centre line, and the brightness distributi

ross the solar disk determined. This brightness curve is essen-lly flat from the sun's centre out to about 0.6 solar radius, dips ightly to a minimum at about 0.9 solar radius, rises to a peak just tside the optical limb, and falls off rapidly beyond the peak. The nb of the 8.6 mm sun is 4740 ± 300 km above the optical limb.

523.164.32

725. INTERNAL PRECISION OF THE DAILY [SOLAR] RADIO LUX OBSERVATIONS AT 10.7 CENTIMETRES. A.E.Covington. Roy. Astron. Soc. Canada, Vol. 53, No. 4, 156-61 (Aug., 1959).

Analysis of 815 simultaneous readings obtained from two dependent radiometers shows that the relative basic probable ror of a single reading is ±1% for a single radiometer. This ust be increased to ±2%, or even ±3%, to include errors in the cording meters and in the variable transmission of the weather-oof dipole. The total relative probable error to be applied to the onthly means of the series of observations which commenced in 47 has the same value.

523.164.4

726. ON SOME PECULIARITIES OF THE MAGNETO-ECELERATING MECHANISM OF NON-THERMAL RADIO MISSION. G.G.Getmantsev.
stron. Zh., Vol. 35, No. 5, 722-9 (1958). In Russian.

It is shown that if cosmic electrons which cause non-thermal smic radio emission are supplied to the periphery of the Galaxy y sources concentrated in the galactic plane, then the adiabatic variant is not conserved when the particles move in an interstellar agnetic field. The possibility of formation of relativistic electrons s a result of nonreversible collisions of relativistic protons with toms of the interstellar medium is discussed.

523.164.85

1727. A NEW METHOD FOR DETERMINING THE RADIANT OF A METEOR STREAM, USING AN ANTENNA OF LOW DIRECTIVITY. .I.Fialko.
stron. Zh., Vol. 36, No. 1, 134-6 (1959). In Russian.

523.164.85

1728. THE EFFECT OF ATMOSPHERIC WIND SHEAR ON THE ISTRIBUTION OF METEOR ECHO DURATIONS. I.C.Browne.
odrell Bank Ann., Vol. 1, No. 5, 245-54 (March, 1958).

Many long-duration radio echoes from meteor trails occur only ter the trails have been distorted by winds into a reflecting con-tion. The inclusion of such echoes in statistical counts of the mbers of echoes of given duration leads to serious errors in the arameters describing the meteor mass distribution. A simple eory is given and shows good agreement with observation. ggestions are made for a more rigorous method of selecting choes for statistical analysis.

523.165

1729. ANTIPARTICLES IN SPACE. E.W.Hones, Jr.
hys. Rev. Letters, Vol. 2, No. 12, 509-10 (June 15, 1959).

Cosmic ray measurements of Perlow and Kissinger (Abstr. 499 of 1951; 373 of 1952) probably imply a ratio of antiprotons to rotons of $< 10^{-8}$ in the Galaxy. A simple experimental arrange-ent for use in earth satellites is suggested which should detect ositrons if their number density is 10^{-14} cm^{-3} or greater.
G.A.Chisnall

523.165 : 537.591

1730. ANISOTROPIES IN COSMIC RADIATION.
.Dattner and D.Venkatesan.
ellus, Vol. 11, No. 2, 239-48 (May, 1959).

The anisotropy of the cosmic radiation outside the geomagnetic eld is discussed and related to various processes in the inter-lanetary gas. Special attention is given to the effect of the density radient in the cosmic-ray distribution, to the earth's orbital otion and to the motion of the interplanetary gas in the solar ystem.

523.166.4

1731. A HIGH RESOLUTION SURVEY OF THE COMA CLUSTER OF GALAXIES AT 408 Mc/s.
M.I.Large, D.S.Mathewson and C.G.T.Haslam.
Nature (London), Vol. 183, 1663-4 (June 13, 1959).

Radio emission observed in the region of the Coma cluster of alaxies is shown to arise in at least three distinct sources. The robability that these sources are not associated with the cluster but represent a fortuitous grouping is about 1 in 30. It is suggested that these sources may be peculiar objects in the cluster. No broad component which could be associated with the normal galaxies or intergalactic material was observed and must represent less than 25% of the total emission.
C.Hazard

523.51 : 537.591.3

11732. PRODUCTS OF COSMIC RADIATION IN THE SIKHOTE–ALIN' METEORITE. É.K.Gerling and L.K.Levskii.
Dokl. Akad. Nauk SSSR, Vol. 123, No. 3, 420-3 (1958). In Russian.

An investigation of the relative contents of isotopes of the light inert gases and the variations of cosmogenic products with depth in large specimens of iron meteorites. A monotonic change of composition with depth is not observed, nor is the expected maximum. An analysis of the data indicates no direct connection between contents of light nuclei and those of the cosmogenic isotopes.
G.A.Chisnall

523.51

11733. ON THE AGE OF METEORITES.
I.E.Starik, M.M.Shats and É.V.Sobotovich.
Dokl. Akad. Nauk SSSR, Vol. 123, No.3 , 424-6 (1958). In Russian.

Uranium and lead contents are determined for a class of meteorites by methods developed previously by the authors and their collaborators (1956, 1958). A graph of Pb^{207}/Pb^{204} against Pb^{206}/Pb^{204} gives an age of $4.45 \pm 0.05 \times 10^9$ years for all stone meteorites examined except Norton County. Ages obtained for some khondrites suggest that the usual uranium abundances are too small. The isotopic composition of lead in the meteorites studied does not show any significant anomalies. Uranium and lead contents appear to be approximately constant and the calculated ages agree with generally accepted ones, thus confirming the uranium contents obtained by the authors.
G.A.Chisnall

523.51

11734. FREQUENCY OF METEORITE FALLS THROUGHOUT THE AGES. J.F.Lovering.
Nature (London), Vol. 183, 1664-5 (June 13, 1959).

It is suggested that meteorites have probably been available to fall on the earth since early Palaeozoic times. The details of an iron meteorite found at a depth of 1525 ft in an oil well are described.
J.M.Hough

523.51

11735. THE POTASSIUM ISOTOPE AS REACTION PRODUCT OF COSMIC RAYS IN CARBO IRON METEORITES.
H.Voshage and H.Hintenberger.
Z.Naturforsch., Vol. 14a, No. 2, 194-5 (Feb., 1959). In German.

The ratio K^{40}/K^{39} is 200 to 575 times and the ratio K^{41}/K^{39} 1.7 to 2.7 times greater than in natural potassium.
J.M.Hough

523.51

11736. He^3–H^3 RADIATION AGE OF A STONE METEORITE.
F.Begemann, P.Eberhardt and D.C.Hess.
Z. Naturforsch., Vol. 14a, No. 5-6, 500-3 (May-June, 1959).
In German.

The tritium and He^3 contents of three samples of the ABEE stone meteorite were measured. Within the experimental limits of error, both are found to be the same at the surface and near the centre of the meteorite. At the time of fall (1952) the tritium activity was (0.26 ± 0.04) disintegrations /(min g). The He^3 content was measured to be $(0.13 \pm 0.01) \times 10^{-6}$ cm^3 STP per gram. The amount of He^3 accumulated and the tritium decay rate yield a maximum radiation age of 30 million years. If it is assumed that equal amounts of He^3 and H^3 are produced by the interaction of cosmic rays with the meteoritic matter, the radiation age is 13 million years. The He^4/U age of the meteorite is greater than 3800 million years. The possible significance of this discrepancy is discussed.

523.7 : 539.16

11737. ASTRONOMICAL TESTS OF THE EXISTENCE OF Li^4.
H.Reeves.
Phys. Rev. Letters, Vol. 2, No. 10, 423-4 (May 15, 1959).

The existence of Li^4 would imply an important change in the proton—proton cycle usually applied in solar models; also a large flux of high energy neutrinos at the earth's surface ($\sim 10^{11}$ cm^{-2} sec^{-1} with mean energy 10 MeV) which could be detected experimentally.
G.A.Chisnall

523.74

11738. ON SOME OBSERVATIONS MADE WITH A POLARIZING DOUBLE IMAGE FLARE PHOTOMETER. K.Fredga.
Ark. Astron., Vol. 2, Paper 17, 183-7 (1958).

Results are presented of recent measurements of solar flares, dark filaments, and plages made with the new Öhman double-image photometer (see Abstr. 3031 and 7729 of 1959). D.R.Barber

523.745

11739. ON THE NATURE OF THE FINE STRUCTURE OF EMISSION OF ACTIVE REGIONS ON THE SUN. I.S.Shklovskii.
Astron. Zh., Vol. 35, No. 6, 838-47 (1958). In Russian.

The excitation mechanism in "emission whiskers" is discussed. It is shown that during the lifetime of w. skers (~200 sec) radiating matter must be renewed not less than several hundred times. Separate clusters of gas of small size, moving in the active region with a velocity of 10^8 cm/sec, interact with the photospheric plasma. This interaction consists of inelastic collisions between hydrogen atoms and of phenomena on the fronts of shock waves which move ahead of the cluster. During this process atoms are excited very effectively. The number of emitted Balmer quanta per every hydrogen atom moving rapidly through the photosphere is ~5. The importance of such a mechanism of de-activation of the excited atoms in the transfer of excitation is emphasized. The total mass of gas in the clusters during the whole lifetime of the active region is $\sim 10^{13}$ g, which is $\sim 3 \times 10^{-4}$ of the mass of the gas in the active region. The energy of the clusters ($\sim 10^{28}$ ergs) is evidently derived from the energy of the magnetic field in the active region. The phenomenon of clusters is analogous to that of plasmoids. Similar phenomenon (the formation of rapidly moving clusters—plasmoids in unstable magnetic fields) take place in the chromosphere (in flare regions) and prominences (explosive prominences). In this case favourable conditions for accelerating charged particles may occur.

523.75

11740. ATMOSPHERIC MAGNETIC FIELDS ABOVE ACTIVE SOLAR REGION OF APRIL 13, 1950. M.Correll and W.O.Roberts.
Astrophys. J., Vol. 127, No. 3, 726-30 (May, 1958).

An analysis was made of a period of well-observed prominence activity over a clear-cut active region at central meridian passage on 13 April, 1950, at N. 13° heliographic latitude. Good-quality Climax west-limb prominence films in Hα revealed that the region had an associated homogeneous field of motions that extended from the region to more than 7×10^4 km. It was found that the trajectories could be well described by assuming that they lay along the lines of force of a magnetic dipole buried 0.03 solar radii below the solar surface, with its axis tilted ±50° from the plane of projection. The projection of the axis was approximately radial. There is evidence that a solar radio-noise storm at meter wavelength was associated with the region and was emitted parallel to the dipole axis rather than in a radial direction from the active region. There was also a geomagnetic disturbance so timed that it may well have resulted from solar corpuscles also emitted parallel to the dipole axis, at the same large angle from the solar radius.

523.75 : 550.38 : 537.591

SOLAR CONTROL OF SOME UNUSUALLY REMARKABLE GEOPHYSICAL EVENTS. See Abstr. 11171

523.75 : 537.591.5

COSMIC-RAY INTENSITY VARIATIONS DUE TO FLARE EVENT OF 23 FEBRUARY 1956. See Abstr. 11180

523.755

11741. RESULTS OF THE 1958 ZÜRICH SOLAR ECLIPSE EXPEDITION. PHOTOMETRY OF THE AERIAL PHOTOGRAPHS OF THE CORONA. M.Waldmeier.
Z. Astrophys., Vol. 48, No. 1, 9-21 (1959). In German.

Gives the photometric results deduced from pictures of the solar corona obtained from an aircraft at the eclipse of 1958 October 12. Shows the radial variation of the intensity along the equator as well as along the sun's axis and along a ray in the SW-quadrant from r = 1.1 to 4.0. Up to r = 2.0 the intensity on the equator is 74% larger than on the solar axis. This difference drops to 23% at r = 4.0. The ratio of the equatorial diameter to the polar diameter of the isophotes decreases from 1.08 in the innermost part of the corona, to 1.06 at r = 4.0. The index of the corona's shape, a + b, amounts to 0.14 or 0.07, depending on the interpretation of the photometric results. This value corresponds to the corona's shape shortly after sunspot maximum. The electron density in the ray of the SW-quadrant is up to r = 1.5 about equal to that of the undisturbed corona, but at r = 2.0 it is 3.3 times and at r = 2.5 even 9.1 times larger than the electron density on the corona.

523.

11742. THE SOURCE FUNCTION IN A NON-EQUILIBRIUM ATMOSPHERE. I. THE RESONANCE LINES. R.N.Thomas.
Astrophys. J., Vol. 125, No. 1, 260-74 (Jan., 1957).

The source function for the central core of resonance lines is investigated under the assumption that the core is formed in the chromosphere. The conclusions reached are as follows: (1) The absorption coefficient is Doppler over a core some three Doppler widths in extent; (2) the frequency dependence of the emission coefficient follows closely that of the absorption coefficient, the difference amounting to about a factor of 4 over the Doppler core, a reg where the absorption coefficient varies by about 10^4; thus the mec anism of line formation is essentially formally equivalent to that o pure absorption or of completely non-coherent scattering, the form distinction between the two fading; (3) completely generally, the source function lies intermediate between a value fixed by collisio excitation with radiative de-excitation and a value fixed by photo-electric ionizations with recapture. For the hydrogen and non-me group and for the neutral metals, the collisional term dominates o for $T_e > \sim 7500°$-$10\,000°$; for singly ionized metals, the collisional term dominates for $T_e > \sim 3500°$. Discussions of eclipse data mak it probable that the cores of the strong resonance lines have chron spheric origin, so the collisional component of the source function may predominate. In this case, a rough knowledge of $n_e(\tau_\nu)$ permi an inference of $T_e(\tau_\nu)$ from the line profile in the region of the co

523

11743. SOURCE FUNCTION IN A NON-EQUILIBRIUM ATMOSPHERE. II. DEPTH DEPENDENCE OF SOURCE FUNCTION FOR RESONANCE AND STRONG SUBORDINATE LINES.
J.T.Jefferies and R.N.Thomas.
Astrophys. J., Vol. 127, No. 3, 667-75 (May, 1958).

An algebraic solution is obtained for the depth variation of th source function $S_L(\tau)$ for resonance and strong subordinate lines using the Eddington approximation plus the method of discrete ordinates. It is shown that if an observed line profile, produced i an atmosphere with the above $S_L(\tau)$, is analysed under the assumt of local thermodynamic equilibrium, an underestimate of $T_e(\tau)$ in the outer atmospheric layer results. The derived $S_L(\tau)$ agrees in qualitative behaviour with the source function found empirically b Athay and Thomas for the early Balmer lines of hydrogen.

523

11744. SOURCE FUNCTION IN A NON-EQUILIBRIUM ATMOSPHERE. III. THE INFLUENCE OF A CHROMOSPHERE.
J.T.Jefferies and R.N.Thomas.
Astrophys. J., Vol. 129, No. 2, 401-7 (March, 1959).

The methods developed in the preceding two papers are appli to investigate the depth dependence of the source function for res ance lines in an atmosphere having a chromospheric distribution T_e superposed upon a photospheric one. The direved behaviour o $S_L(\tau)$ for the neutral and ionized metals differs and mimics the ob served behaviour of such lines. The hydrogen Balmer lines shou behave like the neutral metals, and the predicted behaviour agree with the authors' earlier empirical results.

52

11745. A NOMOGRAPHIC METHOD FOR DETERMINING THE SCATTERING AND ABSORPTION COEFFICIENTS FROM SOLAR LINE PROFILES. J.Waddell.
Astrophys. J., Vol. 125, No. 3, 747-9 (May, 1957).

A nomograph is given for determining these coefficients fro profile observations at two specified positions on the solar disk. Milne–Eddington model is assumed in the determination. The c ordinates of the nomograph are also given, so that it can be modi

523

11746. LIMITATIONS ON PHYSICAL THEORIES OF H AND K EMISSION LINES. O.C.Wilson.
Astrophys. J., Vol. 126, No. 3, 525-8 (Nov., 1957).

A satisfactory physical theory of the H and K emission line in the sun and stars has not yet been developed. By considerati of existing observations, certain requirements of and limitations upon such theories are established. If τ_0 is the optical thickness

line centre, N the number of Ca II ions per square centimetre tical column, L the luminosity (visual), and $\Delta\lambda_D$ the Doppler ith, the following items must be accounted for: (A) Emission pro- ed in optically thin layers ($\tau \gg 1$). (1) $\Delta\lambda_D \propto L^{1/6}$. (2) N un- stricted except for upper limit on τ_0. (3) Mechanism for adequate ission from thin layers. (B) Emission produced in optically thick ers ($10 \leq \tau_0 \leq 10^4$). (1) Both $\Delta\lambda_D$ and N must vary appropriately h L. (2) The rate of variation of $\Delta\lambda_D$ with L must lie within the ximum and minimum rates, which, together with the correspond- variations of N_e, are, respectively, $\Delta\lambda_D \propto L^{1/5}$, $N \propto L^{-1/4}$ and $D \propto L^{1/9}$, $N \propto L^{1/2}$.

523.77

747. THE METALLIC CHROMOSPHERE AT THE KHARTOUM LIPSE. J.B.Zirker.
trophys. J., Vol. 127, No. 3, 680-713 (May, 1958).

Logarithmic emission gradients and absolute integrated emission functions of height are presented for moderately strong metal es. The gradients are controlled by the combined action of self- sorption and the chromospheric density gradient. Self-absorption evaluated for a number of metal lines, from which follows an timate of the density distribution through the low chromosphere. e cores of many metallic Fraunhofer lines appear to originate in chromosphere.

523.77

748. ON ABSORPTION EFFECTS IN PROMINENCES POSSIBLY ONNECTED WITH A MAGNETIC COOLING MECHANISM OPOSED BY L.MARSHALL. Y.Öhman.
trophys. J., Vol. 128, No. 1, 92-4 (July, 1958).

A number of observations indicating the presence of regions in ominences of low excitation are discussed. For the interpretation, ference is made to a magnetic cooling mechanism proposed recent- by Marshall (1957).

523.77

749. THE CENTER—LIMB VARIATION OF THE INTENSITIES F SELECTED SOLAR LINES. W.E.Mitchell, Jr.
strophys. J., Vol. 129, No. 1, 93-118 (Jan., 1959).

A comparison is made between the observed and predicted ntre—limb variation in the equivalent widths of certain Fraunhofer nes. The lines have been selected chiefly for their (1) sensitivity temperature and/or electron pressure; (2) low strength; and) location in spectral regions with well-defined continua. The ectron pressure distribution of the modified Aller—Pierce model combined with the temperature distribution derived from Pierce's cent limb-darkening data, and stratification of the model is taken to account completely in predicting the centre—limb behaviour of e chosen lines. When the predicted equivalent widths are made to ree with those observed at the centre of the disk, the intensities served at the limb in general exceed the predicted values. The screpancies are interpreted as temperature and/or pressure rrections to the adopted model. On the assumption that the temp- ature in the continuum-forming region is reliably determined om limb-darkening data, it is suggested that in the adopted model e electron pressure is too high by a factor of 2 at around $T = 5200^0$. he influence of the velocity field on the lines having greater satura- on is discussed.

523.77

750. CHROMOSPHERIC INTERFEROMETRY. P.J.Treanor.
onthly Not. Roy. Astron. Soc., Vol. 117, No. 1, 22-35 (1957).

The interference spectrum of the brighter lines in the chromo- here of the uneclipsed sun has been photographed by means of the xford 35 m solar telescope, used in conjunction with a Fabry—Perot alon of high reflectivity and large range, and a low dispersion ectrograph. The very narrow spectroscope slit was set tangential- to the 32 cm solar image. Under these conditions, the emission nes of hydrogen, helium and calcium appear as a system of inter- rence fringes, with a resolving power of nearly 10^5. A method is eveloped for the quantitative photometric analysis of the fringe sys- m, from which it is possible to determine chromospheric line- ofiles as a function of height, and the chromospheric intensity adient. This technique has been employed to determine the profile the D_3 line of helium. It is found to be nearly independent of height er the range 1500-4250 km, and, after correction for the effect of ne structure and photometric broadening, corresponds closely to a aussian distribution of the form

$$I = I_0 \exp[-(\delta\lambda/0.34)^2].$$

hese results are interpreted as implying that there is little self-absorption, and that the atoms which give rise to the line are subject to turbulent velocities of the order of 17 km/sec.

523.77

11751. THE PROFILES OF CHROMOSPHERIC Hα AND D_3 FROM INTERFEROMETRIC OBSERVATIONS. S.V.M.Clube.
Monthly Not. Roy. Astron. Soc., Vol. 118, No. 1, 18-30 (1958).

Five plates showing the chromospheric D_3 and Hα lines as sets of interference fringes are analysed by Treanor's method (see preceding abstract). This reduction, for the lowest 3000 km in the chromosphere, gives a D_3 profile which shows no systematic change with height (intensities normalized) and an Hα profile whose broadening decreases from 1.15 A at 200 km to 0.795 A at 3200 km. It is supposed therefore that the Hα line is broadened in part by self-absorption, and a method of eliminating this is described. Assuming that the significant contributions to the Hα and D_3 emissions come from the same regions in the chromosphere, it is deduced from a comparison of the resultant helium and hydrogen Doppler profiles that the turbulent velocity is about 16 km/sec and that, though the temperature cannot be accurately determined, it is probably higher than that of the photosphere.

523.78 : 551.524.35

FLUCTUATIONS OF ATMOSPHERIC TEMPERATURE ACCOMPANYING A SOLAR ECLIPSE. See Abstr. 11657

523.774

11752. "THREE-STREAM" MODEL OF THE SOLAR PHOTOSPHERE. II. THE INFRARED Ni LINES 7789 AND 7798A. H.H.Voigt.
Z. Astrophys., Vol. 47, No. 3, 144-60 (1959). In German.

For previous part, see Abstr. 5318 (1959). The centre—limb variation of these lines (χ_{ex} = 1.9 and 3.4 eV) was observed with high dispersion (0.2 A/mm). The line profiles are calculated by taking into account the inhomogeneities of temperature according to a "three-stream" model. Damping is taken into account too. The half-widths are insensitive to the temperature inhomogeneities; their centre—limb variation yields a microturbulence, increasing with the height in the photosphere from very low values to about 2 to 3 km/sec in the upper layers. The line 7798A shows a small uncertain asymmetry only in the centre of the solar disk; also, the theoretical profile is surprisingly symmetrical, though the contributions of the single streams are displaced and asymmetrical. The different effects compensate each other completely. Therefore no more infomation can be obtained in this way. It seems that only lines of high excitation give a noticeable asymmetry. But, as already noticed before, the observed lines are more "V-shaped" whereas the lines calculated with a normal "one-stream" model become more "U-shaped". By using a three-stream model this discrepancy becomes smaller but it does not disappear. This seems to be the most important starting point for further studies. The other line 7789 shows a strong asymmetry which is constant over the sun's disk in total disagreement with the theoretical calculation. One concludes that an unknown blend is situated on one side of this line.

523.83

11753. ELECTROSTATIC INTERACTIONS IN WHITE DWARFS. F.C.Auluck and V.S.Mathur.
Z. Astrophys., Vol. 48, No. 1, 28-33 (1959).

The electrostatic energy has an effect of the order of a few per cent on the calculated electron-density of white dwarfs and also on the Chandrasekhar's limit for the mass of degenerate configurations.

523.84

11754. STELLAR PULSATION. IV. A SEMITHEORETICAL PERIOD—LUMINOSITY RELATION FOR CLASSICAL CEPHEIDS. J.P.Cox and C.Whitney.
Astrophys. J., Vol. 127, No. 3, 561-72 (May, 1958).

A period—luminosity relation is derived on the basis of the assumptions that (1) a phase lag of about $\pi/2$ radians in the emitted flux leads to instability; (2) the phase lag may be taken as

$$\varphi(x^*) = \frac{2\pi}{\Pi}\int_0^{x^*} \frac{\rho c_V T}{\Lambda F}\,dx,$$

where (3) x^* is the depth of 50% ionization of He^+; (4) Λ may be computed as though variations of flux are predominantly radiative in the region producing the instability; and (5) the stellar envelopes may be represented by n = 1.5 polytropes. The assumptions restrict our quantitative discussion to classical cepheids. The derived (Π, L) relation agrees quantitatively with the empirical for classical cepheids

cepheids if one adopts a semiempirical mass-luminosity relation. The (II, L) relation for W Vir stars is derived when one adopts $M \cong 1.25\ M_{\odot}$ for these stars. Assumptions 2-4 can be only partially justified at present.

523.841.9

11755. ATMOSPHERIC ECLIPSES. I. A.P.Linnell.
Astrophys. J., Vol. 127, No. 1, 211-23 (Jan., 1958).

Increasingly numerous binary systems exhibiting atmospheric eclipses require a more comprehensive theory of such effects than is presently available. Equations developed for this purpose permit calculation, under specified assumptions as to the character of the extended atmosphere, of fractional light-losses when a star with an extensive atmosphere eclipses a main-sequence star.

523.851

11756. DISTRIBUTION OF GRAVITATIONAL FIELD AT THE CENTER OF GLOBULAR AND SPHERICAL CLUSTERS.
F.C.Bertiau and P.H.Roberts.
Astrophys. J., Vol. 128, No. 1, 130-8 (July, 1958).

The distribution of gravitational field within an infinite random distribution of stars has been calculated by earlier workers and gives rise to the Holtsmark distribution. But in astronomical applications (in a globular cluster, for example) the density of stars is by no means uniform everywhere but decreases rapidly with distance from the centre of the cluster. The effect of this "cut-off" is examined in two models. It is shown, in each example, that, at the centre of the cluster, the Holtsmark distribution is adequate for fields greater than the mean of the individual fields produced by the stars of the cluster — that is, for fairly close encounters. For small fields (distant encounters) the deviations are found to be important, particularly when the number of stars in the cluster is small.

523.852

11757. THE ABSOLUTE MAGNITUDE OF CLUSTER NEBULAE AND THE AGE OF THE UNIVERSE. A.Hnatek.
Z. Astrophys., Vol. 47, No. 3, 137-43 (1959). In German.

The values of the Hubble factor H, calculated for a number of clusters and groups on the assumption that the absolute magnitude of the brightest nebula in each cluster is $M = -19.85$, show a considerable scattering about the mean value 180 km sec^{-1} megaparsec^{-1}. An improved representation is obtained by dividing the clusters into two groups and assuming that, within each group, H is a linear function of velocity, $H = H' + H''v$. The estimates of the age of the universe derived from the values of H' for the two groups are 5.4 and 7.2×10^9 years. The postulate of a single value for H' would imply appreciable variation in M. R.A.Newing

523.852 : 537.533

EMISSIVITIES OF A DISTRIBUTION OF HIGH-ENERGY ELECTRONS IN NEBULAE. See Abstr. 11128

523.852.2

11758. ON THE GALACTIC HALO. V.A.Razin.
Astron. Zh., Vol. 35, No. 6, 829-37 (1958). In Russian.

The analysis of data on the spectra and linear polarization of non-thermal galactic radio emission leads to the conclusion that the relativistic electrons, responsible for non-thermal galactic radio emission, move in the interstellar gas with a concentration $n \sim (1\text{-}2) \times 10^{-3}$ cm^{-3}. The condition of gravitational equilibrium of the galactic halo gives $n \sim 10^{-2}$ cm^{-3}. It is therefore natural to suppose that the main mass of gas in the galactic halo is concentrated in comparatively dense clouds. Detection by Münch of gas clouds far from the galactic plane can be considered as a confirmation of this hypothesis. The relativistic electrons move between the gas clouds and probably hardly penetrate into the clouds.

523.872

11759. THE PREDICTION OF MODEL-ATMOSPHERE LINE PROFILES WITH AN ELECTRONIC COMPUTER. A.M.Heiser.
Astrophys. J., Vol. 125, No. 2, 470-7 (March, 1957).

A programme has been developed for the computation of a line profile, formed under the assumption of pure absorption and taking into account the effects of an assumed model atmosphere. The calculations, which included a detailed theory of the broadening of a spectral line, were performed using an electronic calculator (IBM 650). About 25 min are required to compute a line profile of 15 points. A comparison was made between the observed profiles of the magnesium triplet at 5175 A and the predicted line profile, using various abundances and two assumed model atmospheres. A curve of growth for this magnesium triplet was constructed by plotting t equivalent width, measured from the computed profiles, against th abundance used to calculate those profiles. Although the program is restricted at present to the prediction of any metal line whose ionization potential is between 7 and 13 eV, it can easily be modifi to include other lines as well as other effects, such as turbulence.

523.8

11760. HYDROGEN LINES IN AN ATMOSPHERE WITH NEAR THERMODYNAMIC RADIATIVE EQUILIBRIUM. W.Grasberger.
Astrophys. J., Vol. 125, No. 3, 750-70 (May, 1957).

The equation of transfer of specific intensity for a gaseous mixture under the condition of near thermodynamic equilibrium ha been derived by Henyey. On the basis of this equation the deviatio of the surface flux from that given by the assumption of local ther dynamic equilibrium within and just outside the lines Hα, Hβ, and Pα is computed for normal main-sequence stars with surface tempe tures ranging from 7000° to 11 500°. It is found that the deviation largest at the exact centre of these lines. Here the flux is lower b 10-20%, with 90% of this deviation due to the influence of the lines Hα, Hβ, and Pα alone. Outside the isothermal core of these lines the influence of lines is negligible, and the deviation (due to the bound-free continua) is only 1-4%.

523.8

11761. ON THE INTERPRETATION OF THE EMISSION SPECTRUM OF LONG-PERIOD VARIABLE STARS. II.
V.G.Gorbatskii.
Astron. Zh., Vol. 35, No. 5, 748-54 (1958). In Russian.

For Pt I, see abstract 2112 (1958). The problem of the origin of bright lines of ionized metals in the spectra of long-period variables is considered. These lines appear in the same layers o the stellar atmosphere as the bright lines of hydrogen. Collisions with free electrons play the main role in the excitation of metallic atoms after the emission maximum is reached. The electron density decreases sharply between the emission maxima and mini due to absorption of energy in the atmosphere. The number of deactivating collisions of excited atoms with electrons diminishes and the intensity of the [Fe II] lines relative to the intensity of the allowed line increases.

523.8

11762. TURBULENT VELOCITIES INFERRED FROM THE H AN K EMISSION LINES IN STELLAR SPECTRA. L.Goldberg.
Astrophys. J., Vol. 126, No. 2, 318-21 (Sept., 1957).

It is shown that the turbulent velocities inferred by Wilson an Bappu (1957) from the widths of the H and K emission lines in stellar spectra, on the assumption of origin in an optically thin layer, can probably be reduced by a factor of 3 or 4 on the not unreasonable hypothesis that the lines are broadened by the Doppler effect in an optically thick atmosphere.

523.8

11763. NON-ADIABATIC STELLAR PULSATION. I. J.P.Cox.
Astrophys. J., Vol. 127, No. 1, 194-210 (Jan., 1958).

The problem of non-adiabaticity in stellar pulsation is treate under very general assumptions concerning the flux law, the ener generation law, and the equation of state of the stellar material. simplified first-order theory is adopted and applied to a number schematic models, for the purpose of ascertaining some general relations between pulsational instability and phase of emitted flux The study of the schematic models reveals the following: (1) in general, a phase lag (positive or negative) in the emitted flux vari ation is not necessarily associated with negative dissipation; (2) i the quasi-adiabatic flux variation shows an abrupt and rather larg drop somewhere within a critical region lying some distance belo the surface, negative dissipation will occur, accompanied by a lar phase lag (positive or negative); (3) the negative dissipation is maximum when the phase lag has a critical value ϕ_c, where ϕ_c depends on the model; for giant star models, $\phi_c \cong \pm \pi/2$. If the partial ionization of a critical element is assumed to be the cause the abrupt drop in the quasi-adiabatic flux variation, then the theo provides a basis for a theoretical period-luminosity-mass relatio The point is also stressed that calculation of the stability coeffici by use of the quasi-adiabatic theory may yield grossly unreliable results.

52

11764. DIURNAL LAPSE OF SIGNALS FROM SPUTNIK III.
G.H.Munro.
Nature (London), Vol. 183, 1549 (May 30, 1959).

The radio signals from the satellite 1958 δ2 have recently ceased to be modulated whilst the satellite is in the earth's shadow, but the modulation is present when the satellite is in sunlight.
H.J.A.Chivers

525.3

11765. CORPUSCULAR RADIATION AND THE ACCELERATION OF ARTIFICIAL SATELLITES. L.G.Jacchia.
Nature (London), Vol. 183, 1662-3 (June 13, 1959).

The orbital accelerations of satellites 1958 β2 and 1958 δ1 show a close correlation with 10.7 cm solar radio flux. Two distinct irregularities in the curve for 1958 δ1 coincide with the only great geomagnetic disturbances occurring in the lifetime of the object. It is suggested that these irregularities are due to the effect of a solar corpuscular stream on the atmospheric density at a height of 200 km.
H.J.A.Chivers

525.3

11766. THE EFFECT OF THE EARTH'S OBLATENESS ON THE ORBIT OF A NEAR SATELLITE. D.G.King-Hele.
Proc. Roy. Soc. A, Vol. 247, 49-72 (Sept. 9, 1958).

The equations of motion of a satellite in an orbit over an oblate earth in vacuo are solved analytically, by a perturbation method. The solution applies primarily to orbits of eccentricity 0.05 or less. The accuracy of the solution for radial distance should then be about 0.001%, and the error in angular travel about 0.001% per revolution. The earth's oblateness has four main effects on the motion:

(1) The orbital plane, instead of remaining fixed, rotates about the earth's axis in the opposite direction to the satellite, at a rate of $10.00(R/\bar{r})^{3.5}\cos\alpha$ deg/day, where α is the inclination of the orbital plane to the equator, R the earth's equatorial radius and $\bar{r}$ the satellite's mean distance from the earth's centre. (2) The period of revolution of the satellite, from one northward crossing of the equator to the next, is $14.5\sqrt{(R/\bar{r})}\sin^2\alpha$ sec greater for an inclined orbit than for an equatorial orbit. (3) The radial distance r from the earth's centre changes. For a given angular momentum the mean r is 14.1 $R/\bar{r}$ nautical miles greater for a polar orbit than an equatorial one. Also, during each revolution r oscillates twice, the amplitude of the oscillation being $0.94(R/\bar{r})\sin^2\alpha$ n miles. (4) The major axis of the orbit rotates in the orbital plane at a rate of $5.00(R/\bar{r})^{3.5}(5\cos^2\alpha - 1)$ deg/day. Thus it rotates in the same direction as the satellite if $\alpha < 63.4^\circ$, or in the opposite direction if $\alpha > 63.4^\circ$. A brief comparison is made between theory and observation for Sputniks 1 and 2.

525.3

11767. VANGUARD MEASUREMENTS GIVE PEAR-SHAPED COMPONENT OF EARTH'S FIGURE.
J.A.O'Keefe, A.Eckels and R.K.Squires.
Science, Vol. 129, 565-6 (Feb. 27, 1959).

The periodic change in the eccentricity of the 1958 β_2 satellite can be explained by the presence of a third zonal harmonic in the earth's gravitational field, whose amplitude is 0.0047 cm/sec² in the surface acceleration of gravity.
G.A.Chisnall

PHYSICS

GENERAL

53

11768. PRESENTATION OF PAUL KIRKPATRICK AS THE OERSTED MEDALIST FOR 1958. V.E.Eaton.
Amer. J. Phys., Vol. 27, No. 6, 388-9 (Sept., 1959).

Remarks made by the Chairman of the committee on Awards in presenting Paul Kirkpatrick for award of the 1958 Oersted Medal in recognition of his notable contributions to the teaching of physics. For Kirkpatrick's reply see abstract following.

53

11769. ON COLLEAGUES AND CLIENTS. P.Kirkpatrick.
Amer. J. Phys., Vol. 27, No. 6, 390-6 (Sept., 1959).

See preceding abstract. Teaching physicists will do well to overcome their present conditioned attitude of automatic opposition to professional educationists. Teaching is still being carried out by traditional methods which lack scientific justification; the eventual establishment of rational procedures in instruction will require sympathetic collaboration between teachers in the several fields and scholars concerned with the philosophy, psychology, and techniques of instruction in general. Although instruction and research operate as an established partnership in universities there are many aspects of competition and interference between them. The growth of research to its present status as a dominant university activity was in part at the expense of the teaching function. It is no longer necessary to nurture research by depressing the interests of instruction, and it would be well for the universities and their students if the place of preference which research has been enjoying were now to be yielded, at least temporarily, to the teaching activity. A crying defect in science instruction is the use of untrained and inexperienced graduate students as instructors, a practice employed by universities but to a lesser degree by liberal arts colleges and scarcely paralleled at all in the public school system. Increasing enrolments are threatening the personal relationship between teacher and student, particularly the teacher's detailed comprehension of his students as individuals in need of specific and nonidentical services.

53

11770. CLASSROOM MODELS OF PARTICLE SYSTEMS.
J.R.Eaton.
Amer. J. Phys., Vol. 27, No. 6, 408-14 (Sept., 1959).

The classroom models described provide means for illustrating many of the important behaviour characteristics of the particles which form nuclei, atoms, molecules, gases, and crystals. The particles are represented by magnets which collide only through the interaction of field forces, and which move about with very little loss of energy. As a consequence, the behaviour of a system may be observed through many particle collisions with but little attenuation in the system energy. The model is effective in demonstrating such behaviour as the movement of electrons in the atom, the random motion of gas molecules, the thermalizing of neutrons, and the movement of electrons in crystals. Although the demonstration is restricted to classical behaviour, it aids in the presentation of the quantum nature of matter.

53

11771. WHO WAS EARNSHAW? W.T.Scott.
Amer. J. Phys., Vol. 27, No. 6, 418-19 (Sept., 1959).

The originator of the theorem that stable equilibrium is impossible for a particle under inverse-square forces alone is identified as the Rev. Samuel Earnshaw (1805-1888), and the original reference is located [Transactions of the Cambridge Philosophical Society, Vol. 7, 97-114 (1842)].

53

11772. PHYSICAL SCIENCES IN OUR SECONDARY SCHOOLS. S.R.Powers.
Amer. J. Phys., Vol. 27, No. 6, 419-23 (Sept., 1959).

This paper covers early recognition of physical sciences; two guiding objectives; development of uniform college entrance courses; trends in enrollments; textbook and laboratory manuals; methods in teaching; supporting claims for present courses; the teacher's education; suggested new developments in physical science courses and in the preparation of teachers with proper education and specialization for success in their work.

53

11773. SCIENCE IN ELEMENTARY SCHOOLS. J.G.Navarra.
Amer. J. Phys., Vol. 27, No. 6, 424-6 (Sept., 1959).

Science has moved to a place of pre-eminence in the elementary school curriculum because of an emerging commitment that "learning is thinking". The effectiveness of a programme is related directly to how clearly the objectives for which it is operated are understood and how realistically the objectives are implemented.

11.08

[illegible] of the precision at present attainable in the know- [illegible] universal constants expressed in terms of the present [illegible] conventional c.g.s. units as compared with the precision [illegible] these conventional c.g.s. units themselves are [illegible] compared to what one has reason to [illegible] to the coming centuries. It is also [illegible] the fact that a proper understanding of [illegible] being fundamental theory is an [illegible] regarding a set of universal constants as a [illegible] a system of units. The adoption of spectroscopically [illegible] wavelengths as standards of length and atomic clocks as [illegible] of time, because of their higher reproducibility and con- [illegible] rather than because of any [illegible] theoretical [illegible] reasons, seems to the author about as far as it is [illegible] at the present time to the detection of [illegible] variation.

53.081

[illegible] OF NEWTON'S LAW THAT FUNDAMENTAL [illegible] AND GRAVITATION AS OF JANUARY 1959 [illegible]

[illegible] Phys. Rev., Vol. 4, No. 4, 967-985 (Aug., 1959).

At a given epoch one wishes a consistent system of values of [illegible] constants and physical laws describing these [illegible] as observed and possibly used for reliable pre- [illegible] It is emphasized that one cannot treat the [illegible] constants one by one, but one instead of a time, but one is [illegible] a system is defined by [illegible] describing a complete analysis and [illegible] of this one simultaneously. The least-squares adjust- [illegible] due to Cohen, Taylor, Layton and Bullard, Austin 1958 is [illegible] compared in an example. A result of new data has [illegible] since the 1955 adjustment and a list of 19 examples [illegible] these constants, either considered or in progress, is pre- [illegible] examined, and discussed. When the results of [illegible] determinations, now being initiated, have become sufficiently [illegible] a new least-squares adjustment will be in order [illegible] of such new measurements as well as those [illegible] determinations are considered. A general method of [illegible] shows that the "best values" as thus [illegible] are [illegible] [illegible] when new data are added at will. [illegible] fundamentally close by penalty to that method the [illegible] [illegible] adjustments.

53.082

A METHOD OF CALCULATING THE EXPERIMENTAL [illegible] WITH A VIEW TO ITS ELIMINATION. P. Vernotte. [illegible] Sci. (Paris), Vol. 248, No. 21, 2968-9 (May 25, 1959).

[illegible] ons with periods 2, 3, 4 .... See C.R. Acad. Sci. (Paris), [illegible] No. 18, 1521-2 (Oct. 28, 1957). These functions can be [illegible] ed by summing the data two at a time, three at a time, etc. [illegible] lt obtained then lies between a definite maximum and [illegible] . As an example the method is applied to some preliminary [illegible] ments of g by the free fall in vacuo method made at the [illegible] de Breteuil.

S. Weintraub

53.083

[illegible] ELIMINATION OF THE EXPERIMENTAL ERROR BY A [illegible] OF CALCULATION WHEN THE RESULT SOUGHT DOES [illegible] [illegible] [illegible]

11788 — MEASUREMENT OF DISTANCE IN GENERAL RELATIVITY

[illegible] terms of the geodesic deviation of null rays. This definition is applied to the Schwarzschild solution and the homogeneous and isotropic cosmological solutions of the Einstein field equations. In the former case the distance is proportional to the radial coordinate of the standard metric and in the latter case it yields the usual cosmological distance. [illegible] scalar, the results are independent of the particular metric used. The relationship of this definition to observation is discussed and it is concluded that it agrees with the astronomical definition of luminosity distance.

11789 — MODEL OF A LINEAR HARMONIC OSCILLATOR IN THE GENERAL THEORY OF RELATIVITY. H. Lanos. Phys. Rev., Vol. 114, No. 5, 1643–7, June 15, 1959.

A model of a linear harmonic oscillator in the general theory of relativity is examined. It is based on a classical model of a point [illegible] consisting of the center of an ideal liquid [illegible] spherical [illegible] space, the classical frequency is again restored.

[illegible] Nuovo Cimento, Vol. 13, No. 3, [illegible]

The Lorentz-covariant approximation method for [illegible] approximation being the physical particle [illegible] the differential equations satisfied by these that charge is [illegible] orders.

11791 — ON THE LORENTZ-COVARIANT [illegible] METHOD IN GENERAL RELATIVITY II SECOND APPROXIMATION. R. Peierls. Nuovo Cimento, Vol. 13, No. 3, [illegible]

The equations of motion and spin to the second [illegible] are calculated by the method derived in Pt. I [illegible] for a point-dipole particle. However, following the [illegible] Infeld and Hoffman, they are derived from the [illegible] tude whereas Papapetrou derived them from an energy [illegible] tensor.

11792 — GRAVITATIONAL MOTION AND RADIATION. [illegible] Nuovo Cimento, Vol. 13, No. 2, 430–41 (July 16, 1959).

It is shown that the secular change of the total [illegible] masses of a system of two bodies, uniformly revolving around each other, is exactly equal to minus the radiated energy — [illegible] computed in previous parts of this paper (Abstr. [illegible]).

11793 — GENERALIZATION OF THE BASIC FORMULA OF [illegible] DYNISTIC MECHANICS FOR SOME PRACTICALLY [illegible] NON-INERTIAL SYSTEMS. N. Sanitesti. Nuovo Cimento, Vol. 13, No. 1, 173–85 (July 1, 1959).

The basic formula of the relativistic [illegible]

is generalized for the so called non relativistic systems. By [illegible] which are meant systems admitting of the same [illegible] rigid bodies, and consequently in which the law of [illegible]

530.12 : 530.145

11794. RELATIVISTIC PARTICLE WITH INTERNAL ROTATIONAL STRUCTURE. T.Takabayasi.
Nuovo Cimento, Vol. 13, No. 3, 532-54 (Aug. 1, 1959).

General kinematical and dynamical aspects of any covariant theory of particles possessing internal angular velocity together with internal angular momentum are analysed. Theory is classified according to the form of subsidiary conditions required. A precise theory is constructed by the aid of a spinor ζ as the kinematical representation of such structure, postulating the equation of motion,

$$2iQ\frac{d\zeta}{d\tau} - ip_\mu\gamma_\mu\zeta - (m'^2/m)\{(\bar{\zeta}\zeta)\zeta - (\bar{\zeta}\gamma_5\zeta)\gamma_5\zeta\} = 0,$$

where ζ is defined along a world line, Q and m represent the structure constants of the original particle, while m' means observable rest mass which can take a certain constant value between zero and m. The equation contains a self-interaction term of the third order, and thus the theory may be considered to represent the particle analogue to the nonlinear field of Heisenberg. Still it can be solved exactly, the result showing that the particle performs, besides its mean rectilinear motion represented by the constant momentum vector p_μ, an orbital zitterbewegung around it, and the synchronized precession of the internal third axis around the constant helicity pseudovector. The theory of Weyssenhoff is included in the present theory as a degenerate case in which the internal angular velocity becomes physically arbitrary. It is expected that a unified model of elementary particles may be reached by quantization starting from this generalized classical model.

530.12

11795. THE SO-CALLED CLOCK PARADOX IN THE THEORY OF RELATIVITY. B.R.A.Nijboer and H.J.Groenewald.
Ned. Tijdschr. Natuurkde, Vol. 25, No. 6, 160-80 (June, 1959).
In Dutch.

The clock paradox is reviewed and explained, emphasis being placed on the fact that only special relativity is required to predict the effect when one's frame of reference is that of the stay-at-home clock, while general relativity is also required for the frame of reference of the clock in the space-ship. The review includes a short account of special relativity, as well as discussions of experimental verification and space-travel aspects. B.Meltzer

FIELD THEORY . QUANTUM THEORY

530.145

11796. HEISENBERG'S CONTRACTING WAVE PACKETS. A.Landé.
Amer. J. Phys., Vol. 27, No. 6, 415-17 (Sept., 1959).

The discontinuous contraction of a wave packet preceded and followed by a continuous expansion controlled by Schrödinger's equation is a much discussed difficulty in the quantum theory of measurement. It is shown to rest on a mistaken interpretation of Schrödinger's equation as a "process equation" and on two different usages of the word "state", first as a subjective expectation state of an observer, then as the physical state of the object, and finally as a subjective expectation state again, with a sudden change of word meaning which of course has no place in a physical theory.

530.145 : 539.12

11797. THE DETERMINATION OF THE PARITIES OF HYPERONS AND K-MESONS. S.M.Bilenkii and R.M.Ryndin.
Dokl. Akad. Nauk SSSR, Vol. 124, No. 1, 63-5 (Jan. 1, 1959).
In Russian.

It is suggested that the reaction $p + He^4 \rightarrow He^4 + Y + K$ observed with polarized proton beams would yield this information, without restrictive assumptions regarding the spins of hypernuclei or that the experiment be performed near the threshold. P.K.Kabir

530.145

11798. TIME REVERSAL AND COMPLEX NUMBERS IN QUANTUM THEORY. E.Fabri.
Nuovo Cimento, Vol. 13, No. 2, 326-43 (July 16, 1959).

Time reversal is in a particular position with respect to quantum theory, because of the intervention of antilinear operators. A discussion of this point should explain the role played by complex numbers in quantum theory. It is suggested to look upon that as an effect of an operational irreversibility of time, this being a consequence of the interaction between quantum system and measuring apparatus, when the irreversibility inherent to this is taken into account.

530.1

11799. FORMULAE FOR FEYNMAN GRAPHS OF ARBITRARY TOPOLOGY. A.Buccafurri and G.Fano.
Nuovo Cimento, Vol. 13, No. 3, 628-36 (Aug. 1, 1959).

A compact formula is given, which collects together for any p turbative order, large numbers of topologically equivalent graphs Problems of enumeration and classification are notably simplified by its use.

530.145 : 539.1

11800. PARITY EXPERIMENTS IN BETA DECAYS. C.S.Wu.
Rev. mod. Phys., Vol. 31, No. 3, 783-90 (July, 1959).

A brief review of these experiments from 1957 to autumn 195 It is also shown how the experiments combine to give a fairly sim; and consistent description of the interactions responsible for the beta-decay of nucleons, muons, pions and K-mesons. Double beta decay, and neutrino and antineutrino capture experiments are also mentioned. J.C.Tayl

530.1

11801. LEE MODEL AND THE LOCAL FIELD THEORY. I.Białynicki-Birula.
Nuclear Phys., Vol. 12, No. 4, 309-13 (Aug. (1), 1959).

The comparison between the Lee model and the usual local field theory is discussed in a certain simple case. The conclusio: is that the difficulties associated with the renormalization in the L model do not appear in the local field theory.

530.1

11802. REMARKS ON THE PROBLEM OF THE MASS QUANTIZATION FOR ELEMENTARY PARTICLES. O.Costa de Beauregard.
C.R. Acad. Sci. (Paris), Vol. 248, No. 7, 932-4 (Feb. 16, 1959).
In French.

The author states that the values of the masses of the curren known particles can be deduced with a good approximation from t formula

$$m = n_b m_b + n_o m_o + n_e m_e,$$

where the n are integers or half-integers and the three mass qua m_e, m_o, m_b (respectively, the electron mass, half the mass of th charged pion, and the average nuclear mass) are in the ratio $\frac{1}{137}$: 13.4. It is argued that gravitational forces (Abstr. 3063 of 1954, 3952 of 1957) are in fact strong and the author proposes the relat (where G_o = gravitational coupling constant)

$$\frac{2\pi G_o m_o^2}{hc} = 1$$

The author also postulates the existence of some selection rule bidding any strong gravitational radiation, since in this schema, gravitational interactions are "rather strong". Cf. Abstr. 3089 of 1959. J.Lasc

530

11803. THE SPIN OF THE PHOTON IN THE PHENOMENOLOGICAL THEORY OF THE ELECTROMAGNETIC FIELD. C.Muzikář.
Czech. J. Phys., Vol. 8, No. 5, 501-9 (1958). In German.

Continuation of Abstr. 7578 (1957): The author shows that, in m dielectrics, the vector which is perpendicular to the potentials d not lie along the direction of the propagation of the wave. It is further shown that the spin of the photon is $\pm\hbar/\lambda^2$ or $\pm\hbar$ if one ad the radiation tensor or the Minkowski tensor, respectively. Sinc these values differ appreciably, and since measurement of the sp can be made conveniently, one has a feasible experimental meth for deciding between the two tensors. P.Ro

530.

11804. RADIATION OF POINT CHARGE, MOVING SYMMETRICALLY ON THE AXIS OF A CIRCULAR HOLE IN AN INFINITE IDEAL CONDUCTING PLANE. V.Bobrinev and V.Braginskii.
Dokl. Akad. Nauk SSSR, Vol. 123, No. 4, 634-6 (1958). In Russia

The radiation field is expressed as a sum of two terms, E_1 + E_2, where E_1 satisfies an inhomogeneous equation with homogene boundary conditions, and E_2 satisfies a homogeneous equation wi

homogeneous boundary conditions. By considering the conditions ıder which either E_1 or E_2 becomes the dominant part of the total ·ld, and by interpolating, a solution for the latter, valid throughout ıace, is obtained. J.W.Gardner

530.145 : 535.33

.805. A METHOD FOR THE DIRECT CALCULATION OF THE PECTRA OF ELECTROMAGNETIC RADIATION ABSORBED OR MITTED BY QUANTUM MECHANICAL SYSTEMS.
.Primas and H.H.Günthard.
elv. phys. Acta, Vol. 31, No. 4, 413-34 (1958). In German.

The observed frequencies ω_{jk} and intensities A_{jk} of emitted or ɔsorbed radiation can be summarized in the idealized spectrum by:

$$Q(\omega) = \Sigma A_{jk}\,\delta\,(\omega-\omega_{jk}).$$

he Fourier transform of $Q(\omega)$ has the properties of a correlation ınction $K(t)$ given by:

$$K(t) = \sum_{j<k} A_{jk}\cos(\omega_{jk}t) = \mathrm{Spur}\{X(t)X(0)\}.$$

is thus possible to calculate spectra directly without solution of ıe eigenvalue problem of the Hamiltonian operators H, which has ıeoretical as well as practical advantages. With certain assumptions more general relation is applicable:

$$\mathcal{R}(t) = 2\sum_{j<k} A_{jk}\exp(i|\omega_{jk}|t) = \tfrac{1}{2}\ \mathrm{Spur}\{e^{-iHt}p^- e^{iHt}p^+\}.$$

$$P^{\pm} = P_x \pm iP_y.$$

'he correlation function permits the setting up of explicit expresions for the intensities as a function of frequencies.

R.C.Seymour

530.145

1806. POSSIBLE TESTS OF THE VALIDITY OF ELECTRO-)YNAMICS AT SHORT DISTANCES.
.Andreassi, P.Budini and I.Reina.
Nuovo Cimento, Vol. 12, No. 5, 488-9 (June 1, 1959).

The measurement of positron—electron annihilation at very high ıergies is proposed as a test of the locality of electrodynamics, vhich avoids the intervention of nuclear properties. For a nonocality of 0.7 fermis the total annihilation cross-section is reduced ıy 2% at 1 GeV and 16% at 10 GeV. G.P.McCauley

530.145

11807. PRECESSION OF THE POLARIZATION OF PARTICLES MOVING IN A HOMOGENEOUS ELECTROMAGNETIC FIELD.
V.Bargmann, L.Michel and V.T.Telegdi.
Phys. Rev. Letters, Vol. 2, No. 10, 435-6 (May 15, 1959).

Covariant classical equations of motion of the spin are formulated for the axial four-vector describing the polarization, and some special cases of practical interest are considered.

W.A.Hepner

530.145

1808. MAGNITUDE OF RENORMALIZATION CONSTANTS.
.G.Gasiorowicz, D.R.Yennie and H.Suura.
Phys. Rev. Letters, Vol. 2, No. 12, 513-16 (June 15, 1959).

Reconsidering Källen's proof that at least one of the renormalzation constants in quantum electrodynamics is infinite, it is rgued that, independent of the gauge used, Källen's proof is not onclusive owing to possible special cancellations. Whether the onstants are indeed finite depends on whether field theory has ome regularity properties quite unsuspected from perturbation neory. W.A.Hepner

530.145

1809. GAUGE INVARIANCE OF BARYON EQUATION.
.Ceolin and T.Toyoda.
Nuovo Cimento, Vol. 13, No. 3, 605-13 (Aug. 1, 1959).

A non-local, but microcausal, interaction is written between the seudoscalar pionic field and the baryonic field ($\pi-\Xi$). This interaction is obtained by the elimination of a field Φ_μ (associated to each spinor field by the requirement that the theory be not only "Lorentz covariant" but "affine covariant") through which the π-meson is coupled to the baryons ($\pi-\Xi$).

530.145

1810. REGULARIZATION AND RENORMALIZATION. . GENERAL PART. E.R.Caianiello.
Nuovo Cimento, Vol. 13, No. 3, 637-61 (Aug. 1, 1959).

A general formalism is presented which permits investigation of the question — under which conditions does a regularization procedure become a renormalization. This is the case whenever the procedure satisfies conditions of two sorts: a first set of conditions is of very general nature and stems only from combinatorial and analytical requirements; a second set restricts both field theories and procedures alike. This paper gives an exhaustive treatment of the first set of conditions and prepares the ground for the study of the second set. The main conclusion will be that the problem of the renormalization of ultraviolet divergencies can be completely bypassed by an appropriate redefinition of the concept of integral, such as is required when hyperbolic equations are considered. The treatment is mathematically rigorous and wholly independent of perturbative methods; it puts the theory on a firm footing for subsequent quantitative studies.

530.145

11811. ON THE SINGULARITIES OF A GENERALIZED BRUECKNER t-MATRIX. M.L.Mehta.
Nuclear Phys., Vol. 12, No. 4, 333-41 (Aug. (1), 1959).

It is shown that the t-matrix defined by taking hole—hole interactions together with particle—particle interactions has the same singularity as the original t-matrix of Brueckner, and in addition a symmetrical singularity above the Fermi-surface.

530.145

11812. GLOBAL SYMMETRY AND A CONNECTION IN ISO-SPACE. H.Nakamura.
Prog. theor. Phys.,Vol. 21, No. 6, 827-36 (June, 1959).

Yang and Mills' idea of a generalized rotation group in iso-space (Abstr. 10793 of 1954) is extended in such a way that one of the boson fields, which are newly introduced there, can be identified with the π-meson field. In this theory iso-space comes to have some correlation with ordinary space-time. Gell-Mann's gobal symmetry results from the theory and the type of interaction between π-meson and hyperon is restricted to pseudo-vector coupling.

530.145

11813. CHARACTERIZATION OF (Y, Z)- AND (Λ, Σ)-MODES. T.Okabayashi.
Progr. theor. Phys., Vol. 21, No. 6, 867-78 (June, 1959).

New assignment of isotopic spin and the concepts of K-mesonic charge and of K-mesonic charge conjugation are introduced in order to characterize (Y, Z)- and (Λ, Σ)-modes. If the selection rule $|\Delta I| = 1/2$ is assumed for weak interactions, suitable combinations of them can be expressed in terms of (Y, Z)-mode, and they are invariant under K-mesonic charge conjugation, and under the rotation in isotopic spin space, owing to the new assignment of isotopic spin. Then in decay processes neutral K-mesons appear always in the (K_1^0, K_2^0) mode. Strong interactions are naturally invariant under the rotation. Therefore the newly assigned isotopic spin can be treated as an absolutely conserved quantity in an approximation. The invariancy of strong interactions under K-mesonic charge conjugation is discussed. It is shown that characteristic features of K-mesonic charge can be united well with a model previously proposed. Thus, close correlation is obtained between the three selection rules of hyperonic charge, isotopic spin and space parity, which characterize the strength of interactions.

530.145

11814. A STUDY OF CHARGE INDEPENDENCE IN TERMS OF KALUZA'S FIVE DIMENSIONAL THEORY. O.Hara.
Progr. theor. Phys., Vol. 21, No. 6, 919-37 (June, 1959).

An attempt is made to give a foundation to charge independence based on the five dimensional theory proposed by Kaluza. It is shown that the fifth coordinate can be identified with the angular variable of the charge space describing the rotation around its third axis, and that a transformation with respect to this coordinate proposed by Klein as a generalization of the gauge transformation is isomorphic to the rotation in a three dimensional Lorentz space. It is shown that this space has a close relation to the charge space.

530.145

11815. ON PERIPHERAL INTERACTIONS BETWEEN ELEMENTARY PARTICLES. L.B.Okun' and I.Ya.Pomeranchuk.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 300-12 (1959). In Russian.

Peripheral interaction between strongly interacting elementary particles can be phenomenologically described in an adequate manner by existing meson theory. It is suggested that the contribution of peripheral interaction can be assessed by determining

from experiment the amplitudes of various processes corresponding to large orbital angular momenta since the latter correspond to large impact parameters. Comparison of the amplitudes found experimentally with those computed theoretically should permit one to obtain some important quantities characterizing strong interactions of elementary particles. Some quantities of this type are the renormalized coupling constants interaction of π-mesons with nucleons and hyperons, the renormalized coupling constants for interaction of two π-mesons, π-meson and K-meson etc.

530.145

11816. NOTE ON THE CONSERVED CURRENT IN THE WEAK INTERACTIONS. S.Okubo.
Nuovo Cimento, Vol. 13, No. 2, 292-302 (July 16, 1959).

The relation between the lack of renormalization and the conserved current is investigated. Furthermore, it is proved under some conditions that one cannot construct a conserved current for the strangeness-violating process. However, if the mass-differences between baryons is neglected, then it is possible to do so and some examples are given. Finally, some speculations on weak interactions are given.

530.145

11817. ON WEAK INTERACTIONS POSSIBLE IN THE FEYNMAN–GELL-MANN SCHEME. V.M.Shekhter.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 581-4 (1959). In Russian.

It is shown that the β-decay current is uniquely defined by the requirement that the divergence of its vector part vanishes. Moreover, the current responsible for hyperon decay should not be conserved. If this were not the case the strong interaction Lagrangian would possess such a symmetry which would contradict the experiments on simultaneous creation of strange particles. As a result, the reaction $\Sigma \to \Lambda + e + \nu$ can occur only by virtue of A-coupling and the results of the experiments proposed by the author must be negative.

530.145 : 530.162

11818. DERIVATION OF THE GIBBS POTENTIAL OF A QUANTUM SYSTEM CONSISTING OF A LARGE NUMBER OF PARTICLES. III. CONTRIBUTION OF BINARY COLLISIONS.
C.Bloch and C.De Dominicis.
Nuclear Phys., Vol. 10, No. 5, 509-26 (April (2), 1959). In French.

For Pt II, see Abstr. 6503 (1959). Starting from an expansion derived previously the contribution to the Gibbs potential of the two-body dynamical correlations is studied, taking into account the statistical correlations. Such a contribution is of interest for low density systems at low temperature. In the zero density limit, it reduces to the Beth–Uhlenbeck expression for the second virial coefficient. For a system of fermions in the zero temperature limit, it yields the contribution of the Brueckner reaction matrix to the ground state energy, plus, under certain conditions, additional terms of the form $\exp(\beta|\Delta|)$, where the Δ are the binding energies of "bound states" of the type first discussed by Cooper. The wave-function of two particles immersed in a medium (defined by its temperature and chemical potential) is also studied. It satisfies an equation generalizing the Bethe–Goldstone equation for an arbitrary temperature.

530.145

11819. SINGLE-PARTICLE ENERGIES IN THE MANY-FERMION SYSTEM. D.J.Thouless.
Phys. Rev., Vol. 114, No. 6, 1383-90 (June 15, 1959).

The ground state is examined of the many-fermion system, using perturbation theory, with particular attention to Brueckner's method. A study of the single-particle propagators in the ground state of the system sheds some light on the relation between the single-particle energies used, for example, in the optical model of nuclear reactions, and Brueckner's self-consistent energies. This leads naturally to the use of a renormalization factor to allow for propagation off the energy shell. It is possible to formulate the perturbation theory entirely in terms of graphs with no fermion self-energy parts, and this method is used to examine the approximations used for this problem, and to relate more closely the calculations of the ground-state energy and of other properties of the ground state.

530.145

11820. A REMARK ON THE LEPTON PROCESSES. S.Gotô.
Progr. theor. Phys., Vol. 17, No. 3, 517-18 (March, 1957).

Assigning zero isospin and strangeness s for leptons and maintaining the relation $Q = I_3 + \frac{1}{2}(n + s)$, where n is the lepton number, some consequences for weak interactions are considered.
W.A.Hepner

530.145 : 539.12

11821. QUANTUM NUMBERS FOR LEPTON PROCESSES. Y.Katayama.
Progr. theor. Phys., Vol. 17, No. 3, 510-11 (March, 1957).

Suggests it would be helpful to introduce two new lepton quantum numbers, beside "lepton number". R.J.N.Phillips

530.145 : 539.12

11822. THEORY OF ELEMENTARY PARTICLES.
H.P.Dürr, W.Heisenberg, H.Mitter, S.Schlieder and K.Yamazaki.
Z.Naturforsch., Vol. 14a, No. 5-6, 441-85 (May-June, 1959). In German.

The equation

$$\gamma_\nu \frac{\partial}{\partial x_\nu}\Psi + l^2 \gamma_\mu \gamma_5 \Psi (\bar{\psi}\gamma_\mu\gamma_5\psi) = 0$$

is analysed. The group theoretical structure of the equation is studied. The equation is invariant under a number of continuous transformations: the inhomogeneous Lorentz group, the transformations of Pauli, Gürsey and Touschek, and the scale transformation $[x \to \eta x$ or $\Psi \to \eta^{3/2}\Psi(x\eta, l\eta)]$. The Pauli–Gürsey group is used for the interpretation of the isospin; the γ_5-transformation of Touschek establishes a quantum number I_N, and the scale transformation leads to a quantum number l_N, both of which are connected with the baryonic and the leptonic number. The strangeness $s = l_N - l_Q$ is suggested to be connected with the discrete groups of the equation and could then be defined and conserved in a 4-manifold. Of the discrete groups only the well-known transformations P, C and T and the reversal of $l (l \to -l)$ are briefly discussed. The vacuum expectation values of products of two field operators are studied. These values are considered to be only in a first approximation invariant under the isospin–group. The deviations from the Pauli–Gürsey symmetry in higher approximations are supposed to be due to the replacement of the state "vacuum" by an idealized state "world", which possesses an infinite isospin; the strange particles are consequently interpreted as states which "borrow" an isospin $\frac{1}{2}$ or 1 from the ground state "world". The concept of "one-particle wave-functions" is discussed. The fermions of finite mass belong to wave-functions obeying a Klein–Gordon spinor equation instead of a Dirac equation. The connection with the conventional formalism of the Dirac equation is treated in detail. The process of charge conjugation springing from these discussions is used for a variation of the methods of approximation needed later on for the determination of mass values and the pion–nucleon coupling constant. The Tamm–Dancoff method is applied in two different forms to an estimate of the masses of nucleons and π-mesons. The masses and the symmetry properties of the particl agree qualitatively with the experimental results. The scattering o π-mesons from nucleons is treated in V by a method related more closely to the Bethe–Salpeter theory than to the Tamm–Dancoff method; the theory leads to a relativistic pseudovector-coupling as the main term and to a value of the coupling constant of the right order of magnitude. The interaction for β-decay is analysed with respect to its symmetry properties. The theory leads to $c_S = cT = cp = 0$ and, in the lowest approximation, to $c_A = -cV$, while in highe approximations the ratio c_A/cV will be somewhat altered. Some mathematical questions are discussed that were raised by Pauli in 1958. For the renormalized operators of the Lee model an integro-differential equation is given that contains only the arbitrarily sma time interval Δt. It is further shown why a linear differential equation leads to δ-functions on the light cone for the propagator, while a nonlinear differential equation can produce there a different kind of singularity.

530.145

11823. FOLDY–WOUTHUYSEN TRANSFORMATION IN CLOSED FORM FOR SPIN $\frac{1}{2}$ PARTICLE IN TIME-INDEPENDENT EXTERNA FIELDS. E.Eriksen.
K. Norske Vidensk. Selsk. Forhandl., Vol. 31, No. 7, 39-46 (1958; publ. 1959).

530.14

11824. A NOTE ON THE PAULI TRANSFORMATION.
B.Touschek.
Nuovo Cimento, Vol. 13, No. 2, 394-404 (July 16, 1959).

Definitions are given of a "simple particle of spin $\frac{1}{2}$" and of a "theory of the Heisenberg type" (Abstr. 2100 of 1959). It is shown

at in a theory of the Heisenberg type simple particles must have ass 0. It is further shown that in order to obtain particles of mass $\neq 0$ from such a theory it is necessary that one should be able to nstruct at least two asymptotic spinors from the spinor of the eisenberg type theory and that these two asymptotic spinors must t transform in the same way under the Pauli transformation. One rticular case: two asymptotic spinors transforming respectively $\exp[\pm i\gamma_5\alpha]$ is discussed as an illustration.

530.145

825. ON A FULL GEOMETRIZATION OF CONSERVATION AWS IN GÜRSEY'S FORMALISM. J.Lukierski.
ovo Cimento, Vol. 13, No. 2, 410-14 (July 16, 1959).

Gürsey's equations (Abstr. 2778 of 1958) for the nucleon are vestigated. Besides the generalized Pauli transformation C' a cond transformation group C'' is introduced. From the unitary rts of C' and C'' an E_4-isospace is constructed. Isotransforma-ns leave the conventional commutation relations invariant. It is own that the baryon number and charge conservation laws are nerated by rotations in E_4 and the isospin-vector I belongs to the , 2, 3) subspace of E_4.

530.145

826. ONE PARTICLE SINGULARITIES OF GREEN FUNCTIONS QUANTUM FIELD THEORY. W.Zimmermann.
ovo Cimento, Vol. 13, No. 3, 503-21 (Aug. 1, 1959).

The singularities of Green functions arising from intermediate cuum and one particle states are investigated.

530.145 : 539.12

827. MATHEMATICAL FORMULATION OF THE GELL-MANN—SHIJIMA SCHEME FOR NEW PARTICLES. S.Hanawa.
ogr. theor. Phys., Vol. 17, No. 4, 592-602 (April, 1957).

It is shown that the theory of d'Espagnat and Prentki (referred as DP) on a mathematical formulation of the Gell-Mann—Nishijima neme can be generalized so as to accommodate particles of higher fermion number. Modifications made for this purpose are: the isospinor formalism is adopted for all kinds of particles stead of DP's isospinor—isotensor mixed formalism; and (ii) the variance under inversion of isobaric-spin-space, imposed by DP a postulate on strong and electromagnetic interactions, is replaced the invariance under a continuous phase-transformation group G_U nerated by the operator U representing isofermion number. These difications lead not only to extension of the framework but also to finement of the theory as follows. In this formalism, (a) the nsformation properties of field variables with respect to G_U are ambiguously determined without resort to the assumption, made DP, that only the Yukawa interactions appear in the interaction grangian; (b) the isofermion number U proves to be the number suffices of the first kind minus that of the second kind, with spect to inversion, of the isospinor describing a particle; and (c) 's identity $Q = I_3 + \frac{1}{2}U$ between the electric charge Q, the third mponent of isobaric spin I_3, and U as well as Racah's identity $= \exp(i\frac{1}{2}\pi U)$ between U and the isobaric parity P follows directly om an identical relation between the transformation groups concerned.

530.145

828. CHARGE SYMMETRY PROPERTIES AND REPRESENTATIONS OF THE EXTENDED LORENTZ GROUP IN THE THEORY ELEMENTARY PARTICLES.
I.Ogievetskii and Chzhou Guan-chzao.
. eksper. teor. Fiz., Vol. 36, No. 1, 264-70 (1959). In Russian.

The extended Lorentz group which includes the complete rentz group and charge conjugation operation is considered. is shown that the use of irreducible projective representations this extended group requires the existence of charge multiplets. arge symmetry and pair production of strange particles follow m invariance under reflections, charge conjugation and the laws conservation of electric and baryon charges. The Pauli—Gursey ansformation holds for free nucleons. The condition of invariance der this transformation also in the case of interaction leads to baric invariance in strong interactions of all particles.

530.145

829. ANALYTIC PROPERTIES OF THE AMPLITUDE FOR THE ATTERING OF A PARTICLE BY A CENTRAL POTENTIAL.
Klein and C.Zemach.
n. Phys. (New York), Vol. 7, No. 4, 440-55 (Aug., 1959).

A new proof is given that the scattering amplitude, considered a function of energy, for fixed momentum transfer, has those alytic properties in the energy variable which imply a dispersion relation. The proof is based on the known behaviour of the Green's function, as the resolvent of a self-adjoint transformation, and on the study of the Born series. The class of potentials considered is the same as in previous studies. It is shown that for potentials of arbitrary strength the Born series converges uniformly to its first term for sufficiently high energies, real or complex. The analytic properties of the scattering amplitude as a function of momentum transfer for fixed real energy are also investigated and used to establish the domain of convergence of partial wave and related expansions. In particular the use of such expansions to define the amplitude in the unphysical region which occurs in the dispersion relation is fully justified for the same domain of momentum transfer for which the relation itself is valid, i.e. $\Delta < 2\alpha$, where Δ is the momentum transfer and α^{-1} the range of the potential. All proofs apply equally to the Schrödinger and to the Klein—Gordon equations.

530.145

11830. ACCURACY OF QUANTUM RESULTS FOR THE MANY-BODY PROBLEM IN THE CASE OF BOSE STATISTICS.
B.T.Geilikman.
Dokl. Akad. Nauk SSSR, Vol. 123, No. 3, 430-2 (1958). In Russian.

The total Hamiltonian for a system of bosons is written as a summation over all their many-body interactions (including annihilation and creation). Replacement of these individual interactions by an average "self-consistent" one is known to give qualitatively correct predictions of superfluid properties. The present paper relates the accuracy of this procedure to the density and configuration (surface—volume ratio) of the boson assembly. J.W.Gardner

530.145

11831. THE GREEN'S FUNCTION METHOD IN QUANTUM STATISTICS. E.S.Fradkin.
Nuclear Phys., Vol. 12, No. 5, 465-84 (Aug.(2), 1959).

A Green's function method in quantum statistics is developed. It is shown that the equations obtained contain in a simple approximation various methods encountered in statistical physics and in the theory of many particles as well as their extensions to cases of non-vanishing temperature (e.g. the Debye—Hückel, Hartree—Fock, Thomas—Fermi, Gell-Mann—Brueckner methods). A transition to time-dependent Green's functions is considered and a method for the determination of the energy spectrum of the system is proposed.

530.145

11832. FUNCTIONAL EQUATIONS AND OPERATOR SOLUTIONS FOR THE STATISTICAL SUM. E.S.Fradkin.
Dokl. Akad. Nauk SSSR, Vol. 125, No. 1, 66-8 (March 1, 1959). In Russian.

The pertubation expansion of the S-matrix used in field theory can be adapted to the density matrix of a grand canonical ensemble, as shown by Matsubara (Abstr. 6397 of 1956). Here this method is applied to a Dirac field and a real Klein—Gordon field interacting with each other and external sources. The author obtains functional equations for the grand partition function by exploiting the relation between the expectation of a field operator or product of field operators on the one hand and variational derivatives of the grand partition function with respect to the source fields on the other. O.Penrose

530.145

11833. A GREEN'S FUNCTION METHOD IN QUANTUM STATISTICS. E.S.Fradkin.
Dokl. Akad. Nauk SSSR, Vol. 125, No. 2, 311-14 (1959). In Russian.

The one-particle Green's functions appearing in the functional equations of the preceding abstract are studied here in more detail. An integro-differential equation for these Green's functions is given, and transformed into the energy and into the momentum representations. The close analogy between these Green's functions and those of field theory is pointed out. O.Penrose

530.145

11834. LAWS OF CONSERVATION OF ANGULAR MOMENTUM AND PARITY IN THE STATISTICAL THEORY OF MULTIPLE PRODUCTION. V.B.Magalinskii.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 93-7 (1959). In Russian.

The general statistical method of microcanonical distribution is employed to compute the statistical weigths of a many-particle system obeying an arbitrary statistics, account being made for the laws of conservation of total angular momentum and parity. A general computational formula has been obtained under the assumption that all particles obey the Boltzmann statistics.

530.145

11835. OPERATOR FUNCTIONS OF THE PION FIELD OPERATOR. G.Barton.
Nuovo Cimento, Vol. 13, No. 2, 363-70 (July 16, 1959).

A method is given for evaluating matrix elements in a bare particle representation of arbitrary operator functions of the pion field operator, with special reference to the functions arising from the equivalence transformation of the leptonic and electromagnetic couplings of nucleons.

530.145

11836. WAVE OPERATORS IN MULTICHANNEL SCATTERING. M.N.Hack.
Nuovo Cimento, Vol. 13, No. 1, 231-6 (July 1, 1959).

A discussion is given of the convergence to the wave operators in multichannel scattering. A necessary and sufficient condition is given for this convergence to hold. A typical example of a multichannel system with one and two body, quadratically integrable, potentials is considered, and it is shown that the convergence holds for this case. Some consequences of the convergence are also discussed. E.J.Squires

530.145

11837. HIGHER BORN APPROXIMATIONS IN NON-RELATIVISTIC COULOMB SCATTERING. C.Kacser.
Nuovo Cimento, Vol. 13, No. 2, 303-18 (July 16, 1959).

The first three Born approximations to the differential cross-section for non-relativistic scattering are calculated by a Yukawa potential in the limit of zero screening. The result agrees with the exact (Rutherford) cross-section for Coulomb scattering. This supports the suggestion made by Dalitz that the (divergent) higher Born approximations for Coulomb scattering act solely as a phase-factor multiplying the first Born approximation matrix-element.

530.145

11838. THE INELASTIC SCATTERING OF ELEMENTARY PARTICLES. P.T.Matthews and A.Salam.
Nuovo Cimento, Vol. 13, No. 2, 381-93 (July 16, 1959).

The requirements of unitarity and causality are used to obtain a convenient set of real constant parameters for the phenomenological description of low energy elementary particle scattering. It is assumed that an arbitrary number of channels are open but that there are just two particles in each channel. This discussion is a direct generalization of effective range theory. The Breit–Wigner and Chew–Low formulae are also derived from this point of view. Unitarity is then used to relate the parameters, below threshold for one or more of the channels, to the larger number of parameters required when all channels are open. Finally these considerations are applied to the K^-–nucleon system.

530.145

11839. THRESHOLD PROPERTIES OF SCATTERING AND REACTION CROSS-SECTIONS. R.G.Newton.
Phys. Rev., Vol. 114, No. 6, 1611-18 (June 15, 1959).

The detailed behaviour of elastic and inelastic scattering cross-sections as functions of the energy at the threshold of a new reaction is derived from general principles. The results lend themselves in certain cases to the experimental determination of spins and parities of reaction products, as well as of not directly observable scattering amplitudes and inelastic cross-sections. A number of special cases are treated in detail.

530.145

11840. CONTRIBUTION TO THE THEORY OF MULTIPLE SCATTERING. M.L.Ter-Mikaelyan.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 253-7 (1959). In Russian.

A method is given for calculation of the multiple scattering curves taking into account finite nuclear dimensions. Experimental results on scattering of fast electrons by nuclei are used in the calculations.

530.145

11841. ON THE SCATTERING MATRIX IN AN INDEFINITE METRIC. L.A.Maksimov.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 465-73 (1959). In Russian.

A method is suggested which, in the theory with an indefinite metric, excludes all nonphysical states from the initial and final states of the system. The method is applied to the Lee model and scalar photon model.

530.145

11842. CALCULATION OF THE SCATTERING PHASE SHIFTS WITH ACCOUNT OF THE SECOND APPROXIMATION.
A.A.Sokolov, V.M.Arutyunyan and R.M.Muradyan.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 594-9 (1959). In Russian.

The elastic scattering phase-shifts for Dirac particles are determined from the interaction potential. The results of the Born approximation, damping theory and also the McKinley and Feshbach formula which is a generalization of the Rutherford–Mott formula, can be derived as special cases.

530.145

11843. PION–NUCLEON SCATTERING AND STRUCTURE OF FOURTH-ORDER MATRIX ELEMENTS IN Ps(Ps) MESON THEORY.
K.Nakabayasi and K.Hasegawa.
Progr. theor. Phys., Vol. 17, No. 4, 581-91 (April, 1957).

The fourth-order S-matrix elements (ME) for elastic pion–nucleon scattering at low energies are analytically evaluated by expanding in powers of mass ratio μ/M, and are analysed in detail so as to compare relative advantages of the existing theories. The scattering phase-shifts are then evaluated using the variation principle for K-matrices. It is found that the main s-wave parts of the ME contain a $\ln(M/\mu)$ term which has no bearing on the recoil effect and has a different sign for crossed and ladder graphs. In connection with this, the reason why the 5-box Tamm–Dancoff (TD) approximation gave essentially isotopic spin independent s-wave scattering is given. It is also suggested that the main recoil p-wave term $\ln(M/\mu)$ appearing only in the crossed graphs can be a possible reason why the I = J = 3/2 p-wave phase-shift does not show resonance behaviour, contrary to that in the 5-box TD method as well as the Chew and Low theory.

530.145

11844. THE PION–NUCLEON DISPERSION RELATION AND SMALL P-WAVE PHASE SHIFTS.
A.Kanazawa, T.Sakuma and S.Furui.
Progr. theor. Phys., Vol. 21, No. 6, 856-66 (June, 1959).

The behaviour of small p-wave phase-shifts is investigated, with use of the integrated forms of the G.M.O. dispersion relations (Abstr. 8509 of 1955), which are free from the ambiguity due to the principal integral of the total cross-sections but are sensitive to the real part of the amplitude at low energies (< 100 MeV). For the (3/2, 3/2) amplitude the result from Puppi's analysis is used beside the experimental data, which greatly reduces the ambiguity due to the lack of precise experimental knowledge on the (3/2, 3/2) phase-shift at very low energies. It is shown that Lomon–Chiu's data on small p-wave phase-shifts are definitely in contradiction with the dispersion relation for the isospin even amplitude. This conclusion is not altered even if every one of the small p-wave phase-shifts is varied by 100%. The disparity is removed, however, if a rather large negative δ_{13} at low energies (< 100 MeV) is used. On the other hand, for the isospin odd amplitude, there is no such disparity irrespective of such alternative choices of the small p-wave phase-shifts with coupling constant of 0.07-0.10.

530.14

11845. DIFFERENTIAL EQUATIONS FOR THE RENORMALIZED FIELDS IN THE POINT SOURCE LEE-MODEL AND SCALAR NEUTRAL MESON THEORY. R.Haag and G.Luzzatto.
Nuovo Cimento, Vol. 17, No. 2, 415-29 (July 16, 1959).

For two simple field theoretical models with infinite renormalization it is shown that the equations of motion can be formulated as differential equations for the renormalized fields involving only finite quantities. Thus the status of the initial value problem is not changed by the infinite renormalization. One has to observe that the field quantities at a sharp time, though not observables, have a well defined meaning as bilinear forms (infinite matrices). The equations involve certain limiting procedures which are closely related to Valatin's work on quantum electrodynamics but are more explicit.

530.14

11846. ANALYTIC PROPERTIES OF THE SCHRÖDINGER AMPLITUDE AT A FIXED ANGLE. J.Bowcock and D.Walecka.
Nuclear Phys., Vol. 12, No. 4, 371-88 (Aug. (1), 1959).

The scattering from a given class of potentials including exchange forces is considered. For a fixed angle the scattering amplitude can be analytically continued into the complex energy plane with the exception of the usual cut along the positive real axis and certain poles and cuts on the negative real axis depending on the

re of the potential. The present results are a partial confirma- of the fixed angle dispersion relations recently proposed within ramework of field theory.

530.145 : 539.165

7. EQUIVALENCE TRANSFORMATION OF THE β-DECAY RATOR. G.Barton.
. Rev. Letters, Vol. 2, No. 5, 224-6 (March 1, 1959).
Starting from γ_5 meson theory, the equivalence transformation radient coupling theory is performed on the nucleon operators in -decay Fermi interaction, with the intention of afterwards making ed source calculation of the renormalization of the axial vector ling constant. However, the transformation itself leads to extra ns, whose affect can be computed exactly and is large.
J.C.Taylor

530.145

48. EQUATION FOR THE N-PARTICLE WAVE-FUNCTION IN E MANY-BODY PROBLEM. B.G.Solov'ev.
l. Akad. Nauk SSSR, Vol. 126, No. 4, 755-8 (June 1, 1959). Russian.
The variational method of Bogolyubov (Abstr. 3719 of 1958), ch treats pair correlations, is generalized to treat the case re N particles are correlated. G.E.Brown

530.145

49. ON ADIABATIC INVARIANCE IN QUANTUM MECHANICS. olsrud.
Norske Vidensk. Selsk. Forhandl., Vol. 31, No. 5, 26-33 (1958; . 1959).
The motion of a charged particle in a homogeneous time- endent magnetic field is studied to illustrate the well-known nection between quantum mechanical and classical adiabatic riance. W.A.Hepner

530.145

50. ON THE ALGEBRA OF ANGULAR MOMENTUM. eckler.
vo Cimento Suppl., Vol. 12, No. 1, 1-40 (1959).
A fundamental presentation of the algebra of angular momentum ensor notation. The author begins with the commutation rule for ular momentum and proceeds from it to the algebra generated by components of an angular momentum vector. It is shown that commutation rule suggests and permits a demarcation of the ele- nts of the algebra into linearly independent sets of tensor opera- which are related to the forms introduced by Racah, Edmonds Rose. Certain algebraic properties of these tensors lead to an rator calculus, fully developed in the paper. This calculus per- s immediate computation of observable quantities, i.e. transition babilities, rather than probability amplitudes; this is exemplified n illustrative problem. Several appendices contain full proofs ll new and important formulae used. J.K.Skwirzynski

530.145 : 539.18

51. HARTREE—FOCK THEORY WITH NONORTHOGONAL IS FUNCTIONS. R.McWeeny.
s. Rev., Vol. 114, No. 6, 1528-9 (June 15, 1959).
Solutions of the Hartree—Fock self-consistent-field equations be approximated by linear combination of a set of basis func- s: the equations then assume a matrix form, as shown by thaan. It is possible, however, to obtain the required variational tion of the many-electron problem much more directly by an ative construction of the density matrix. This method, first eloped by the author for expansion in terms of orthogonal basis ctions, is extended to the case of a nonorthogonal set.

530.145

52. CLUSTER DEVELOPMENT METHOD IN THE QUANTUM CHANICS OF MANY PARTICLE SYSTEM. I.
vamoto and M.Yamada.
gr. theor. Phys., Vol. 17, No. 4, 543-55 (April, 1957).
In order to investigate the many-particle system by the varia- al principle, the cluster development method proposed by row is systematically formulated. It is a direct generalization ne Hartree method, in which two particle functions are included ne trial function to represent the correlations between particles. energy expectation value is expanded in a series, each term of ch is expressed in cluster integrals. It is found that the series verges rapidly when the correlations are marked only for small icle separations, so that this method is expected to be useful ecially for the system of particles interacting through short range ntials with repulsive cores.

530.145

11853. ON THE SPACE-TIME FORMULATION OF NON-RELATIVISTIC QUANTUM MECHANICS. I.Fujiwara.
Progr. theor. Phys., Vol. 21, No. 6, 902-18 (June, 1959).
For the case of the quantization of the usual non-relativistic classical Lagrangian function quadratic in the velocity, the validity is demonstrated of the non-canonical space-time formulation of quantum mechanics previously proposed by the author, which aims to evaluate, without appealing to the Schrödinger equation, the transformation function $K(x, t''; y, t')$ in the space representation on the basis of the composition rule

$$K(x, t''; y, t') = \int K(x, t''; z, t)dz\, K(z, t; y, t') \qquad (1)$$

coupled with the supposition that it is approximated to zeroth order in the quantum of action h by the so-called semi-classical kernel

$$K_C(x, t''; y, t') = [(i/h)\partial^2 S/\partial x \partial y]^{1/2} \exp[(i/\hbar)S(x, t''; y, t')] \qquad (2)$$

written in terms of the classical action $S(x, t''; y, t')$ alone. In the first place the action function corresponding to the above Lagrangian is expanded as a power of the interval of time $T = t'' - t'$. Then the deviation of the semi-classical kernel (2) from the unitary transformation function is shown to be of the third order in T, and the corresponding correction term is evaluated by solving the integral equation (1). It is also shown that the semi-classical kernel is unitary for a free motion of a particle with its mass being a function in the space coordinate.

530.145

11854. SYMMETRY GROUP OF AN ISOTROPIC OSCILLATOR. Yu.N.Demkov.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 88-92 (1959). In Russian.
The equivalence is established of the determinations of the isotropic oscillator group with the aid of the infinitesimal operators and generating elements suggested earlier by the author (1953-54) and with the aid of the canonical transformations presented by Baker (Abstr. 7158 of 1956). The explicit form of the group unitary operators is considered and the relation to the Green's function for an oscillator is demonstrated.

530.145

11855. FOCK'S EXPANSION FOR THE WAVE-FUNCTIONS OF A SYSTEM OF CHARGED PARTICLES.
Yu.N.Demkov and A.M.Ermolaev.
Zh. eksper. teor. Fiz., Vol. 36, No. 3, 896-9 (1959). In Russian.
Fock's method [Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 18, 161 (1954)] is generalized for arbitrary systems of charged particles and for states of any symmetry.

STATISTICAL MECHANICS
TRANSFER PROCESSES

530.162

11856. ON THE CORRELATION FUNCTIONS FOR SYSTEMS OF SINGLY-CHARGED PARTICLES. V.P.Galaiko and L.É.Pargamanik.
Dokl. Akad. Nauk SSSR, Vol. 123, No. 6, 999-1002 (1958). In Russian.
The correlation functions are constructed by the method of iteration, which enables one to find the corrections in any approximation. The physical significance of the method is also elucidated.
P.Roman

530.162

11857. ON COLLECTIVE AND INTERNAL MOTIONS IN A BOSE SYSTEM. T.Nishiyama.
Progr. theor. Phys., Vol. 17, No. 5, 711-32 (May, 1957).
By introducing a number of auxiliary variables, quantum-mechanical collective and internal motions in a Bose system are described. In a collective representation obtained here, the wave-functions are expressed as functions of the auxiliary variables and the internal coordinates. The energy for the ground state and the excitation energies of collective motion and internal motion are obtained for the case of a long-range interaction potential. The lowest energy obtained proves to be smaller than that afforded by the Hartree—Fock approximation. The excitations of the collective motion with smaller wave-numbers than a cut-off wave-number k_c correspond to Landau's phonons. The excitations of the internal motion resemble Landau's rotons; but they are forbidden for the

smaller wave numbers $K \leq k_c$. When this method is applied to the problem of liquid helium, it becomes necessary to take account of the two-body correlation of individual particles. It is pointed out that the phonon energy depends upon the zero-point motion of the individual particles.

530.162 : 536.48

11858. ON THE THEORY OF THE MULTIPLE FORMATION OF ELEMENTARY EXCITATIONS. V.T.Khozyainov.
Dokl. Akad. Nauk SSSR, Vol. 122, No. 6, 1003-6 (1958). In Russian.

The multiple formation of excitations in a quantum liquid such as superfluid helium due to the decay of energy W in volume V is discussed. The relative probabilities of the various decay processes are calculated on the assumption that all final states are equally probable. The numbers of final states S_n (W), corresponding to the formation of n excitations, are derived for both the separate and simultaneous formation of phonons and rotons. An estimate is thus made of the average number of phonons and rotons produced by the process. A graph is given which shows the dependence of the average number of excitations produced on the initial energy W.
M.G.Priestley

530.162 : 530.145

GIBBS POTENTIAL OF A MANY-PARTICLE QUANTUM SYSTEM. BINARY COLLISIONS. See Abstr. 11818

530.162

11859. ON THE LINEAR PHENOMENOLOGICAL EQUATIONS. II. THE LINEAR STATISTICAL MECHANICAL THEORY.
R.J.Bearman.
J. chem. Phys., Vol. 31, No. 3, 751-5 (Sept., 1959).

For Pt I, see Abstr. 2289 (1958). The phenomenological equations, including inertial and viscous terms, are derived from statistical mechanical theory. The influence of the additional terms is evaluated with reference to their effect on the operational significance of the phenomenological coefficients and on the interpretation of diffusion data.

530.162

11860. A NEW METHOD IN STATISTICAL PERTURBATION THEORY. Chen' Chun'-syan'.
Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1518-21 (1958).
In Russian.

A modified version of statistical perturbation theory is proposed which consists in setting up a model of a dynamical system whose Hamiltonian parametrically contains the inverse temperature. It is shown that for this dynamic system the perturbation theory is equivalent to the ordinary statistical perturbation theory and is much more convenient for practical calculations.

530.162 : 517.9

SOLUTION OF EQUATIONS BY THE METHOD OF PERTURBATIONS. See Abstr. 11708

530.162

11861. REMARK ON RECURRENCE TIMES. M.Kac.
Phys. Rev., Vol. 115, No. 1, 1 (July 1, 1959).

A simple derivation is given of the mean recurrence time of a linear chain of harmonically bound particles. The derivation is based on a formula of Smoluchowski.

530.162

11862. ON THE LIMITS OF APPLICABILITY OF THE QUASI-CLASSICAL EQUATION OF STATE OF MATTER. D.A.Kirzhnits.
Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1545-57 (1958).
In Russian.

Quantum corrections to the equation of state obtained with the aid of the Thomas–Fermi model have been found. It is shown that at all temperatures and densities the lowest order quantum and exchange corrections to the pressure are negative, their ratio not exceeding $\frac{1}{5}$; it equals $\frac{1}{5}$ in the degenerate electron gas region and $\frac{1}{3}$ in the high temperature region. The boundary of the temperature and density region has been determined for which the relative contribution of the quantum correction to the pressure is small and application of the Thomas–Fermi model is feasible.

530.162

11863. ON A RELATION IN QUANTUM STATISTICS.
E.S.Fradkin.
Zh. eksper. teor. Fiz., Vol. 36, No. 3, 951-3 (March, 1959).
In Russian.

For a system with a Hamiltonian of the form $H_0 + \lambda H_1$, the author uses a method taken from the field theory of the S-matrix to obtain a formula for the logarithmic derivative of the grand partition function with respect to λ. This formula can be written in terms of a Green's function, and by integration, with respect to λ, a formal expression for the logarithm of the grand partition function is obtained. O.Penrose

530.1

11864. STATISTICAL MECHANICAL THEORY OF TRANSPORT PROCESSES. XII. DENSE RIGID SPHERE FLUIDS.
S.A.Rice, J.G.Kirkwood, J.Ross and R.W.Zwanzig.
J. chem. Phys., Vol. 31, No. 3, 575-83 (Sept., 1959).

For Pt XI, see Abstr. 2173 (1958). The theory of transport in a dense fluid of rigid spheres is developed from classical statistic mechanics by the use of phase space transformation functions. A modified Maxwell—Boltzmann integro-differential equation for the distribution function in μ space is derived, and the difference between this equation and the Enskog equation is discussed. To obta a formulation of the stress tensor and heat flux solely in terms of binary collisions, it is necessary to allow the time of coarse graining to be very short. The implications of this are discussed with relation to the general principles of the statistical mechanic of transport. The viscosity and thermal conductivity of the dense rigid sphere fluid are calculated. The viscosity is the same as that first computed by Enskog, but the thermal conductivity differs from his calculations.

530.1

11865. STATISTICAL MECHANICAL THEORY OF TRANSPORT PROCESSES. XIII. KINETIC THEORY OF DENSE RIGID SPHERE FLUIDS. S.A.Rice.
J. chem. Phys., Vol. 31, No. 3, 584-94 (Sept., 1959).

Details of the calculation of the coefficients of shear viscosity and thermal conductivity are discussed for a moderately dense flu of rigid spheres based on a modified Boltzmann equation previous derived. The physical significance of short time smoothing and it effect on the computed transport coefficients is briefly considered

530.

11866. ON THE THEORY OF RELAXATION. III. THE INCLUSIO OF MICROSCOPIC INERTIAL EFFECTS IN THE FRAMEWORK O THE STATISTICAL-THERMODYNAMIC THEORY. S.Kästner.
Ann. Phys. (Leipzig), Folge 7, Vol. 3, No. 1-2, 82-93 (1959).
In German.

For Pt II, see Abstr. 6539 (1959). Using as a starting point Meixner's (Abstr. 5852 of 1958) generalized formulation of Krame equation of Brownian motion with N degrees of freedom, the therm dynamic equations of relaxation are derived for the case that the distribution function differs little as regards its dependence on t momenta, from the equilibrium distribution. In the equations app the usual terms depending on the free energy density and the diss pation function for the system, but also a term related to the kine energy density, which therefore takes account of microscopic ine effects. F.Ansbach

530.162 : 535

11867. SIMULTANEOUS DIFFUSION OF PHOTONS AND PARTICLES. B.A.Veklenko.
Optika i Spektrosk., Vol. 6, No. 2, 262-5 (Feb., 1959). In Russian

The author discusses an assembly of radiating atoms in an infinite space, assuming simultaneous diffusion of photons and ato and finds a criterion for determining when either transport of ato or transport of photons can be neglected. A.Tybulewi

530.162 : 53

A NOTE ON THERMODYNAMICS OF THE HARMONIC OSCIL LATOR WITH RADIATION DAMPING. See Abstr. 10938

GENERAL MECHANICS
MECHANICS OF SOLIDS

531.1

868. ON THE STATICS AND THE KINEMATICS OF A OSSERAT CONTINUUM". W.Günther.
handl. Braunschw. Wiss. Gesell., Vol. 10, 195-213 (1958).
German.

The "Cosserat continuum" is a continuum of points each of which provided with a space direction vector. In this paper, the kine-tics and the statics of such a continuum are developed and invest-ated; the author emphasizes the analogies between equations for tical and for kinematical quantities. The tensor formulation is ed throughout and finally it is shown that the continuum used in the ometrical study of the dislocation theory of crystals is an incom-tible "Cosserat continuum". J.K.Skwirzynski

531.261.35

869. THE EXPANSION [IN SERIES] OF THE POTENTIAL NCTION OF THE MUTUAL ATTRACTION OF TWO ELLIPSOIDS OMOGENEOUS AND NON-HOMOGENEOUS). V.T.Kondurar'.
tron. Zh., Vol. 35, No. 5, 763-71 (1958). In Russian.

531.36

870. CONCERNING INERTIAL MOTION.
.Azpiroz Yoldi and J.Goñi Mateo.
n. Real Soc. Espan. Fis. Quim., Vol. 55A, No. 5-6, 149-56.
fay-June, 1959). In Spanish.

The problem of inertial motion on the earth's surface is solved d the equations of the trajectories are obtained. Possible partic-ar cases are also discussed, and the values of the coordinates pressed in terms of time. The most significant numerical values some trajectories are computed.

531.6 : 539.37

871. ELASTIC AND PLASTIC BEHAVIOR IN THE IMPACT OF YLINDERS AGAINST PLATES. M.E.Backman.
appl. Phys., Vol. 30, No. 9, 1397-403 (Sept., 1959).

A theory of the indentation of a thick plate from impact by a flat-ded elastic cylinder is derived from elastic and plastic theories d compared with experimental values for 2024-T4 aluminium alloy, lf-hard naval brass and Armco iron. Plastic conditions in plates the aluminium alloy are considered in detail by assuming an ex-nential increase in hardness to a maximum value. These results e sensitive to projectile length and are compared to experimental sults for five projectile lengths.

MECHANICAL MEASUREMENTS

531.711 : 539.18

ATOMIC BEAM SOURCES AND THE STANDARD OF LENGTH.
e Abstr. 11520

531.714.7

1872. DIAPHRAGM TYPE AIR-MICROMETER. I. STATIC HARACTERISTICS. Y.Nakayama and H.Endō.
ull. Japan Soc. Mech. Engrs, Vol. 2, No. 6, 210-17 (May, 1959).

The micrometer has an air chamber that is partitioned from all to wall by a corrugated diaphragm, in the centre of which a mall aperture is bored to serve as an inlet or outlet throttle, epending on the direction of air flow. The characteristics of the strument are the combined characteristics of an ordinary air-icrometer and the deflecting characteristics of the diaphragm. ven at large magnification, the non-linearity of its characteristic ay be ignored, giving a wide linear range of measurement.

531.717.1 : 539.12

1873. ON THE QUESTION OF USING THULIUM-170 FOR EASURING THE THICKNESS OF MATERIALS.
.A.Ulmanis and N.A.Dubinskaya.
atv. PSR Zinat. Akad. Vestis, No. 4(129), 89-94 (1958). In Russian.

Measurements are reported on the transmission through various hickness of iron and aluminium of the 84 and 52 keV γ-rays from repared samples of Tm^{170}. G.P.McCauley

531.758 : 545.844

GAS DENSITY METER. IMPROVED DESIGN OF MARTIN–JAMES METER. See Abstr.11618

531.781

11874. BEARING DYNAMOMETER. R.V.Klint and R.S.Owens.
Rev. sci. Instrum., Vol. 30, No. 9, 775-7 (Sept., 1959).

A dynamometer has been devised and built which enables ready evaluation of bearing materials. Coefficient of friction and shaft speed are presented on an X—Y recorder. By varying the load on the bearing a family of curves may be quickly obtained yielding the basic performance characteristics of the bearing materials under actual bearing conditions. Prolonged tests can be performed during which observation of the bearing characteristics as a function of time can be studied. Bearings of $\frac{1}{2}$ in. diameter have been studied to speeds of 2000 rev/min and coefficients of friction to 0.7. These ranges are easily extended. The speed determination is made by a d.c. tachometer-generator. The essential element of the friction measuring system is a linear variable differential transformer acting as a transducer for the friction torque of the bearing.

MECHANICS OF FLUIDS

532

11875. ON THE PHYSICS OF FLUIDS. R.J.Seeger.
Amer. J. Phys., Vol. 27, No. 6, 377-87 (Sept., 1959).

In connection with the concept of the "physics of fluids" as part of a broad, interdisciplinary field, the historical development of the concept of the fluid itself is outlined. The three major fields are hydrostatics, hydrodynamics, and aerodynamics. The use of the fluid concept in physics generally is mentioned. The paper concludes with modern fluids, i.e. the understanding of real fluids under the major headings of (1) ordinary fluids, involving stability, anomalous viscosity, and free surfaces; (2) fluids under unusual conditions, such as high-speed, high-temperature, low-density, and quantum fluids; (3) large-scale phenomena involving fluids, those that are local in character, such as planetary atmosphere, and those that are cosmic, such as magnetohydrodynamics. Attention is called to the use of high-speed computing machines and the understanding of real fluids.

532.133 : 541.182.025

11876. ELASTICITY AND STRENGTH OF PLASTIC DISPERSED SYSTEMS IN CONNECTION WITH THE PHENOMENON OF THIXOTROPY. V.P.Pavlov and G.V.Vinogradov.
Dokl. Akad. Nauk SSSR, Vol. 122, No. 4, 646-9 (1958). In Russian.

Grease of various compositions is examined in a concentric cylinder apparatus in steady rotation and under transient conditions. Measurements of the shearing stress can thus be interpreted in terms of a yield value (breaking stress) and a shear modulus. Results are described in some detail and shown in graphs in which the stress is plotted against time and against the strain.

R.Eisenschitz

532.133

11877. FACTORS AFFECTING THE NON-NEWTONIAN VISCOSITY OF RIGID PARTICLES. J.T.Yang.
J. Amer. Chem. Soc., Vol. 81, No. 15, 3902-7 (Aug. 5, 1959).

The viscosities of two poly-γ-benzyl-L-glutamate samples and a mixture of them were measured as a function of shearing stress τ (up to 10^5 dynes cm^{-2}) in m-cresol in which the polypeptides exist as rod-like α-helices. Marked reduction in the intrinsic viscosity $[\eta]$ (to less than 5% of its value at $\tau = 0$ for the high molecular weight sample) can be achieved at the highest attainable τ. The data support findings [J. Amer. Chem. Soc., Vol. 80, 1783 (1958)], thus further confirming the validity of the viscosity theories for rigid particles. The shear dependence of $[\eta]$ of a rigid system gives a composite curve independent of solvent viscosity and temperature T when $[\eta]$ is plotted against τ/T. The critical shearing stress τ_c (above which the viscosity drops sharply) depends upon the size and shape of the polymers. The longer the particles, the smaller is the τ_c. The effect of polydispersity results in a broadening of the non-Newtonian region and gives higher apparent length L_{app} at lower rate of shear D. The mean length at zero shear, however, is smaller than L_{app} under finite shear. The controversy on the so-called power law of viscosity is partly attributed to the effect of polydispersity which can cause the viscosity to obey a pseudo-odd function of τ or D.

532.133

11878. VISCOSITY OF MOLTEN SILICA.
J.F.Bacon and A.A Hasapis.
J. appl. Phys., Vol. 30, No. 9, 1470-1 (Sept., 1959).

The viscosity of fused silica (Amersil fused quartz with an impurity content of approximately 0.01% by weight) in the temperature range of 2050° to 2350°C has been found to fit an extension of lower temperature viscosity data taken from Landolt–Börnstein. The fused silica was degassed in a tungsten crucible at 10^{-5} mm Hg for 4 to 5 days until the vacuum could be maintained at 1550°C. Compatibility studies showed that, when graphite is not present, tungsten does not react with silica up to 2500°C. R.Schnurmann

532.133

11879. ON THE VISCOSITY OF FLUIDS.
A.Carrelli and E.Ragozzino.
Nuovo Cimento, Vol. 13, No. 3, 555-61 (Aug. 1, 1959).

In a fluid with unsymmetric molecules there is a dependence of the viscosity on the gradient of speed. A theory of this effect is given, which can be developed exactly only for a gas. Experiments made with some liquids and solutions are described which, confirming the existence of the variation, show that for some fluids it can be so great as to allow an experimental determination of the characteristic geometrical parameters of the molecules.

532.517.2

11880. STATIONARY MOVEMENT OF A VISCOUS INCOMPRESSIBLE LIQUID IN A TUBE. O.A.Ladyzhenskaya.
Dokl. Akad. Nauk SSSR, Vol. 124, No. 3, 551-3 (1959). In Russian.

A proof is given to show that for the flow through an unbounded tube at least one stationary laminar solution of the hydrodynamical equations exists under very general assumptions with regard to the forces and for every value of the Reynolds number.
R.Eisenschitz

532.517.2

11881. STABILITY OF TWO-DIMENSIONAL SZYMAŃSKI FLOW.
H.Takami.
J. Phys. Soc. Japan, Vol. 14, No. 4, 517-22 (April, 1959). In Esperanto.

The stability of a two-dimensional transient flow of an incompressible viscous fluid is investigated by the method of small oscillations. The basic flow is such that the fluid begins to move from rest between two parallel and infinitely large planes under a pressure of constant gradient applied along them and eventually attains the parabolic velocity distribution. By the use of Lin's procedure the relation between the Reynolds number of the basic flow and the wave number of the antisymmetrical neutral oscillation (the neutral curve of stability) and also the minimum critical Reynolds number are calculated numerically for each of five representative stages of the transient flow, and the variation of its stability characteristics is discussed.

532.517.2 : 536.24

HEAT TRANSFER TO LAMINAR FLOW BETWEEN PARALLEL PLATES WITH A [SYMMETRICALLY] PRESCRIBED WALL HEAT FLUX. See Abstr. 10902

532.517.2 : 536.24

GROWTH OF THE THERMAL BOUNDARY LAYER IN LAMINAR FLOW BETWEEN PARALLEL FLAT PLATES. See Abstr. 10902

532.517.4

11882. NON-SIMILARITY THEORY OF DECAYING TURBULENCE.
Y.Shigemitsu.
J. Phys. Soc. Japan, Vol. 14, No. 1, 91-103 (Jan., 1959).

As a development of the author's statistical theory of turbulence (Abstr. 3522 of 1956), an extension of the initial-period similarity-law of decaying turbulence (isotropic turbulence, wake, jet) is attempted so that non-similarity characters may be included. Based upon the cascade conception that large vortices produce small ones successively, a Poisson process of the mixture of these vortices is introduced and non-stationary expressions of Reynolds stress and Euler correlation are derived. By evaluating them approximately a decay law deviating gradually from the linear-decay-law is obtained. For the case of isotropic turbulence, double correlation functions are determined by substituting Kármán–Howarth's self-preserving solution into the formula, and a triple correlation h is derived by solving Kármán–Howarth's equation with the evaluated u^2 and f. These theoretical results are checked by previous experimental data.

532.517.4

11883. ON THE SPECTRUM OF A PASSIVE SCALAR MIXED BY TURBULENCE. A.D.Wheelon.
J. geophys. Res., Vol. 63, No. 4, 849-50 (Dec., 1958).

A justification of the author's dimensional arguments (Abstr. 4005 of 1957) on turbulent mixing, giving an approximate spectrum of irregularities in a passive scalar quantity on the assumption that diffusion effects are less important than convection in the low wave-number portion of the spectrum. J.G.Oldroyd

532.517.4

11884. ON THE ROLE OF CONVECTIVE TRANSFER IN TURBULENT MIXING. R.Bolgiano,Jr.
J. geophys. Res., Vol. 63, No. 4, 851-3 (Dec., 1958).

See preceding abstract. A criticism chiefly of Wheelon's approximate treatment of the selfmixing term (coupling irregularities at different wave-numbers) in the turbulent diffusion equation.
J.G.Oldroyd

532.517.4

11885. A SUMMARY OF THE TURBULENT MIXING DILEMMA.
A.D.Wheelon.
J. geophys. Res., Vol. 63, No. 4, 854-5 (Dec., 1958).

See two preceding abstracts. An assessment of the rival approximate treatments of the diffusion equation with a turbulent convection term, calling for experimental results on scatter of electromagnetic signals to help resolve the ambiguities.
J.G.Oldroyd

532.517.4 : 536.24

EDDY DIFFUSIVITIES FOR MOMENTUM AND HEAT.
See Abstr. 10903

532.517.4 : 536.24

HEAT TRANSFER TO TURBULENT NON-NEWTONIAN FLUIDS. See Abstr. 10905

532.5

11886. INITIAL WEDGE IMPACT ON A COMPRESSIBLE FLUID.
S.F.Borg.
J. appl. Phys., Vol. 30, No. 9, 1432-6 (Sept., 1959).

A physical model is developed and a solution is obtained for rigid two-dimensional wedge impact on a compressible fluid. The solution is given as a comoined compressible flow–elastic viscous body action. The combined solution satisfies the field equations for the physical model assumed for the impact and, approximately, the necessary boundary conditions. It holds for a semicircular wedge, expanding similar to itself with time and entering the fluid at a velocity equal to half the velocity of sound. Hence, it applies best t wedges with pointed noses. Approximate procedures are given for solving noncircular shapes moving with arbitrary velocities. An order-of-magnitude estimate is made for the time of importance of compressibility effects.

532.582.

11887. THE FORCES EXPERIENCED BY A LATTICE OF ELLIPTIC CYLINDERS IN A UNIFORM FLOW AT SMALL REYNOLDS NUMBERS. S.Kuwabara.
J. Phys. Soc. Japan, Vol. 14, No. 4, 522-7 (April, 1959).

Using Imai's general method of solving two-dimensional Oseen's equations, the drag and lift coefficients for a lattice of parallel, equal and equidistant elliptic cylinders in a uniform flow at small Reynolds numbers are calculated. When stagger is not present and the thickness ratio of the elliptic cylinders is taken to be unity, the expressions for these coefficients reduce to the case of a lattice of equal and equidistant circular cylinders which has been investigated by Tamada and Fujikawa.

532.582.

11888. THE FORCES EXPERIENCED BY RANDOMLY DISTRIBUTED PARALLEL CIRCULAR CYLINDERS OR SPHERES IN A VISCOUS FLOW AT SMALL REYNOLDS NUMBERS.
S.Kuwabara.
J. Phys. Soc. Japan, Vol. 14, No. 4, 527-32 (April, 1959).

The forces experienced by parallel circular cylinders or spheres which are distributed at random and homogeneously in a viscous flow are investigated on the basis of Stokes' approximation. The results for the case of spheres are applied to the problem of sedimentation and compared with several experimental data.

532.584

1889. DETERMINATION OF TURBULENCE CHARACTERISTICS SOLID PARTICLES IN A TWO-PHASE STREAM BY OPTICAL TOCORRELATION. S.L.Soo, C.L.Tien, and V.Kadambi. v. sci. Instrum., Vol. 30, No. 9, 821-4 (Sept., 1959).

Application of optical autocorrelation techniques enables the ermination of Lagrangian correlation, scale, and intensity of bulent motion of solid particles in a two-phase stream. This thod allows measurement of both longitudinal and transverse relations.

532.612 : 536.422

1890. SURFACE TENSION AND HEAT OF SUBLIMATION OF LICON, GERMANIUM AND TIN. S.N.Zadumkin. tverdogo Tela, Vol. 1, No. 4, 572-3 (April, 1959). In Russian.

The author used his formula derived for cubic face-centred tals [Dokl. Akad. Nauk SSSR, Vol. 112, No. 3, 453-6 (Jan. 21, 57)] to calculate the surface tension σ and its temperature efficient $d\sigma/dT$ for Ge, Si and α-Sn, whose structures can be garded as superpositions of two cubic face-centred lattices. ese formulae involve heats of sublimation at 0°K, which were en from published work. The calculated values of σ and $d\sigma/dT$ 1208°K for Ge, 1693°K for Si and 503°K for Sn agreed well with experimental results. A.Tybulewicz

532.65 : 551.574

1891. A THEORETICAL POWER-LAW FOR THE SIZE DISTRIBUTION OF SMALL PARTICLES OR DROPS FALLING THROUGH THE ATMOSPHERE. P.Welander. Tellus, Vol. 11, No. 2, 197-201 (May, 1959).

A theoretical study is made of the size distribution of small rticles or drops in the atmosphere as produced by vertical motion d coalescence. It is demonstrated that a power-law distribution is possible solution both in the time-dependent case, when conditions e assumed to be spatially homogeneous, and in the steady-state se. The theory is applied to cloud droplets falling and coalescing der the effect of gravity and Stokes friction. In this case it is nd that the frequency distribution falls off as r^{-5} in the time-pendent case, and as r^{-3} in the steady-state case, r being the dius. A comparison with observed size distributions of droplets the range 20–80μ given by Wieckmann and aufm Kampe (1953) dicate that, on an average, the r^{-5} distribution and the r^{-3} distribution are reasonable approximations for fair weather cumulus clouds d for cumulus congestus- and cumulonimbus clouds, respectively. the time-dependent case the theory predicts that the concentration droplets of a given size should change inversely to a linear function of time. After a definite time T, infinite concentrations are ached and the model breaks down. This characteristic growth e is inversely proportional to the initial concentration of particles. r the mean concentration of cloud droplets given by Weickmann d aufm Kampe, T takes on values of the order 150 sec, assuming t only droplets which differ in radii less than 10 times coalesce.

532.696.1

1892. RELATION OF WETTABILITY BY AQUEOUS SOLUTIONS TO THE SURFACE CONSTITUTION OF LOW-ENERGY SOLIDS. J.K.Bernett and W.A.Zisman. J. phys. Chem., Vol. 63, No. 8, 1241-6 (Aug., 1959).

Contact angles of a variety of pure anionic and non-ionic rface-active agents in aqueous solutions of various concentrations re measured on smooth, clean surfaces of two low-energy solids, lyethylene and Teflon. Wettability curves were obtained for each lid surface by plotting the cosine of the contact angle versus the rface tension of each solution. The critical surface tension of ch solid thus obtained agrees well with previous values established om studies with various pure organic liquids. Aqueous solutions ose surface tensions are lower than 30 dynes/cm were found to read on polyethylene, whereas no solution had a surface tension v enough to spread on Teflon. The ability of aqueous solutions to read on an organic low-energy solid surface were related to the lue of γ_c of the solid and to the surface tension of the solution rupt changes in slope were found in all wettability curves of celle-forming compounds. The discontinuities for both surfaces curred at approximately equal concentrations for a given wetting ent and were essentially determined by a change in the adsorption the solution–air interface and not at the solid–solution interface. e concentrations at which the breaks in slope occurred were close the reported critical micelle concentrations but were slightly wer. Compounds which were unable to form micelles did not produce discontinuities in slope of the wettability curves. Two wetting properties of the aqueous solutions at high concentration of wetting agent were precisely those to be expected of organic liquids having the same surface composition and packing as the outermost (or hydrophobic) portion of the film of wetting agent at the air-solution interface. This means that the presence of the low-energy solid surface has little effect on the adsorption, orientation or packing of the wetting agent. These conclusions allow a rational explanation of all the observations reported on wetting agents. It is concluded that the minimum concentrations of the polar solute required to cause spreading on polyethylene and on Telfon are excellent indices of the effectiveness of the solute to function as a wetting agent. A reference standard for rating wetting effectiveness, which is less demanding than polyethylene, would be polystyrene or polyvinyl chloride.

MOLECULAR THEORY OF LIQUIDS

532.7

11893. FREE ENERGY OF A NONUNIFORM SYSTEM. III. NUCLEATION IN A TWO-COMPONENT INCOMPRESSIBLE FLUID. J.W.Cahn and J.E.Hilliard. J. chem. Phys., Vol. 31, No. 3, 688-99 (Sept., 1959).

For Pt II, see Abstr. 6858 of 1959. By finding the saddle point in the expression derived in Pt I (Abstr. 8612 of 1958) for the free energy of a nonuniform system, the authors have derived the properties of a critical nucleus in a two-component metastable fluid. At very low supersaturations, it was found that the properties of the nucleus approach those predicted by the classical theory that assumes the nucleus to be homogeneous with an interfacial energy that does not vary with curvature. However, with increasing supersaturation, the following changes occur in the properties of the critical nucleus: (a) The work required for its formation becomes progressively less than that given by the classical theory, and approaches continuously to zero at the spinodal; (b) the interface with the exterior phase becomes more diffuse until eventually no part of the nucleus is even approximately homogeneous; (c) the composition at the centre of the nucleus approaches that of the exterior phase; (d) the radius and excess concentration in the nucleus at first decrease, then pass through a minimum and become infinite again at the spinodal. These properties are deduced without resort to any specific solution model. In addition, they are evaluated for a regular solution to permit a quantitative comparison with the predictions of previous treatments.

532.7

11894. NOTE ON THE CLUSTER EXPANSION THEORY OF CLASSICAL FLUIDS. WATERMELON APPROXIMATION. R.Abe. J. Phys. Soc. Japan, Vol. 14, No. 1, 10-14 (Jan., 1959).

The irreducible clusters appearing in the cluster expansion theory of fluids are classified according to the number of branch points, to which three or more bonds are connected. All the terms arising from the irreducible clusters with two and only two branch points are summed up and the contribution of these terms to the free energy is obtained exactly in a simple closed form. This permits improvement in the results of calculation of the thermodynamic functions based on Montroll and Mayer's method, in which only clusters without branch points are taken into consideration. This summation procedure seems to be necessary to avoid the divergence difficulty in the case of Coulomb interaction between particles in quantum mechanical systems as well as in classical systems.

532.7

11895. ON THE STABILITY OF A FERMI LIQUID. I.I.Pomeranchuk. Zh. eksper. teor. Fiz., Vol. 35, No. 2(8), 524-5 (Aug., 1958). In Russian. English translation in: Soviet Physics—JETP (New York), Vol. 38(8), No. 2, 361-2 (Feb., 1959).

The variations in small deviations from equilibrium of the distribution function of excitations of a Fermi liquid are studied, and the criterion for stability of the Fermi surface with respect to such deformations calculated. S.J.St-Lorant

532.7 : 538.2

11896. THE BEHAVIOUR OF THE ANTIMONIDES OF ALUMINIUM, GALLIUM, AND INDIUM IN THE LIQUID STATE. V.M.Glazov and A.A.Vertman. Dokl. Akad. Nauk. SSSR, Vol. 123, No. 3, 492-4 (1958). In Russian.

The authors have measured the temperature dependence of the

magnetic susceptibilities of these three compounds in the liquid state. For each compound the susceptibility has two maxima. These results are discussed in relation to other temperature-dependent properties of these liquids, especially the viscosity. The authors attribute the first maximum to an increase of coordination number on heating, and the second to dissociation. O.Penrose

532.7 : 539.2

MAXWELL–AMPERE CONFERENCE — LONDON, 1959.
See Abstr. 11542

532.72

11897. MASS TRANSFER IN LAMINAR BOUNDARY LAYERS CALCULATED BY MEANS OF A PERTURBATION METHOD. H.J.Merk.
Appl. sci. Res. A, Vol. 8, No. 4, 237-60 (1959).

The macroscopic equations for combined heat and mass transfer discussed previously (Abstr. 10632 of 1959) are simplified and applied to transfer of momentum, heat and mass in laminar boundary layers. The mass transfer is described in a fairly general manner, as was indicated first by Spalding (1954). On the assumption that the Lewis number is unity, the heat transfer is easily related to the mass transfer. This relation is restricted to low values of the Mach number, but it does account for the dependence of the enthalpy on the concentration, the latter effect having been apparently neglected in the literature hitherto. For flat plates the dependence of the Sherwood number on the Schmidt number and on the differences in concentration is investigated, the latter effect being expressed in terms of a dimensionless transfer parameter B. For low values of B the Sherwood number is obtained as an explicit function of the Schmidt number in the range $0.5 < Sc < \infty$. Furthermore, the Sherwood number is calculated for large values of the Schmidt number and finite values of B. The results of the calculations are compared with some other calculations found in the literature. It is shown that the approximations used in the present paper result in suitable formulae for rapid calculation of the Sherwood number.

532.72

11898. MASS TRANSFER IN THE LAMINAR BOUNDARY LAYER ALONG A FLAT PLATE CALCULATED BY MEANS OF THE INTEGRAL METHOD. H.J.Merk.
Appl. sci. Res. A, Vol. 8, No. 4, 261-77 (1959).

The approximation method propounded by von Kármán and Pohlhausen for hydrodynamic boundary layers has been applied to the calculation of the mass transfer in the laminar boundary layer along a flat plate without longitudinal pressure gradient. The velocity and concentration profiles are represented by polynomials of the 4th degree in terms of the distance from the wall. It is shown that for mass transfer this method leads to a rather complicated system of formulae. The calculations based upon this method are performed for several values of the Schmidt number Sc: 0.1., 0.6., 1, 2, 5, 10, 50 and 100. The general trend of the results is in accordance with the exact theory. However, it appears that the numerical work involved is extensive and its accuracy disappointing. Furthermore, for Schmidt numbers lower than 1 the approximation method fails at certain negative values of the transfer parameter B.

532.72

11899. ASPECTS OF THE PHENOMENOLOGICAL THEORY OF DIFFUSION. W.G.Kauman.
Bull. Acad. Roy. Belgique Cl. Sci., Vol. 45, No. 2, 108-15 (1959).

Two phenomenological diffusion theories based, respectively, on thermodynamics of irreversible processes and on a dynamical method are compared. It is shown that both formulations correctly describe the diffusion process, and that the selection of the appropriate scheme for a particular problem is a matter of convenience. The formulation according to irreversible thermodynamics appears, however, preferable for problems involving the differential diffusion equation. The matrix of coefficients connecting the two formulations is calculated explicitly in a form applicable to all reference frames for the bulk velocity.

532.72

11900. SELF DIFFUSION IN WATER.
D.C.Douglass and D.W.McCall.
J. chem. Phys., Vol. 31, No. 2, 569 (Aug., 1959).

The coefficient of self-diffusion for protons in a range of D_2O—H_2O mixtures up to that containing 80% D_2O has been studied at 25.5°C using the N.M.R. spin-echo technique. The data obtained are compared with those of Adamson and Irani [J. Amer. Chem. Soc., Vol. 79, No. 11, 2968 (June 5, 1957)]. The results of the present work agree adequately with their values obtained using O^{18} tracer techniques, but are in sharp disagreement with the results of "protium-diffusion" experiments. S.A.Aber

532.7

11901. SELF DIFFUSION OF ZINC IN MOLTEN ZINC BROMIDE. L.E.Wallin and A.Lundén.
Z. Naturforsch., Vol. 14a, No. 3, 262-4 (March, 1959), In German.

The self-diffusion coefficient, D, was measured between 400°C and 640°C using a capillary method. The result was

$$D = 79 \times 10^{-3} \exp(-16060/RT),$$

where D is in $cm^2\ sec^{-1}$ and R in cal $mole^{-1}\ deg^{-1}$. B.T.M.Will

532.739

11902. THE SOLUBILITY OF BENZENE IN WATER. D.M.Alexander.
J. phys. Chem., Vol. 63, No. 6, 1021-2 (June, 1959).

In the temperature range between 0.8°C and 65.4°C the values ΔG^0, the standard free energy of solution, calculated from $\Delta G^0 = -29389 + 541.273T - 169.090T \log T$ have been found to agree well with observed values. For the latter the ultraviolet absorption spectra of specially prepared solutions of purified benzene in water were compared with those of a series of standard solutions of benz in water. R.Schnurman

532.77 : 536

11903. STATISTICAL THERMODYNAMICS OF POLYMER SOLUTIONS. II. EXCLUDED VOLUME EFFECT AND SECOND VIRIAL COEFFICIENT. E.F.Casassa.
J. chem. Phys., Vol. 31, No. 3, 800-8 (Sept., 1959).

For Pt I, see Abstr. 8621 (1958). The theory of the second virial coefficient in polymer solutions is modified to take account of the fact that in a good solvent the mean dimensions of two interacting linear molecules are increased beyond random-flight-size through both intermolecular and intramolecular mutual volume exclusion among chain segments. Since the model for a bimolecular cluster bears a formal resemblance to a cruciform branched chain a method for calculating the dimensions of such polymers can be applied to the two-molecule problem. This treatment improves the agreement of calculated virial coefficients with experiment as compared with the simpler assumption, made in the original formulation of the theory, that each molecule of an interacting pair is expanded independently in consequence of intramolecular interactions alone

532.

11904. SOLUTIONS OF ALKALI METALS IN POLYETHERS. I. F.Cafasso and B.R.Sundheim.
J. chem. Phys., Vol. 31, No. 3, 809-13 (Sept., 1959).

Potassium, rubidium, and caesium have been found to dissolve in 1,2-dimethoxyethane and some of its homologues to give blue, electrically conducting solutions. Although sodium alone is insoluble, it is carried into solution by solvents already containing potassium. Approximate values for the solubilities and electrical conductivities are given at several temperatures. The optical absorption spectra for the region 300 mμ to 2.5 μ and the results of electr paramagnetic resonance studies are reported. Many features of these solutions clearly parallel those of the corresponding solution of alkali metals in liquid ammonia or in amines. The properties of rubidium solutions are distinctly different from those of the other alkali metal solutions.

532.

11905. X-RAY DIFFRACTION ANALYSIS FOR MIXTURES OF DIOXANE WITH WATER SOLUTIONS OF MANGANESE SULPHAT OR CUPRIC SULPHATE. F.Cennamo and E.Tartaglione.
Nuovo Cimento, Vol. 13, No. 3, 344-9 (July 16, 1959).

X-ray diffraction analysis shows that the opposite action of Mn^{++} and Cu^{++} on water molecules (dissociating for Mn^{++} and associating for Cu^{++}) takes place even in three-component system containing water, each of the ions and dioxane in different proport

532.7

11906. THE INFLUENCE OF POLARIZATION OF LIQUID CRYSTAL MOLECULES ON THE SCATTERING OF SLOW NEUTRONS. J.A.Janik, S.Kraśnicki and A.Murasik.
Acta phys. Polon., Vol. 17, No. 6, 483-7 (1958).

Using the nematic phase of p-azoxyanisol, which occurs in the temperature interval 116°-134°C, an almost completely polarized scattering sample was obtained by aligning the magnetic domains

an external magnetic field. A well-collimated mono-energetic neutron beam was obtained from the EWA reactor by reflection from an Al crystal, and passed through the polarized sample. Neutron transmissions at 0.037 and 0.25 eV were determined using BF_3 counters, with random and aligned targets. At 0.037 eV a transmission decrease of ~ 1-2% was obtained from the polarized sample, whilst at 0.25 eV the reverse was true. This result is qualitatively explained on the theory proposed by Krieger and Nelkin by assuming that two motions in the molecule are responsible. Good quantitative agreement is expected on small refinements of the calculations.
A.E.I. Research Laboratory

532.783 : 548.737

11907. DIFFRACTION OF X-RAYS BY A LIQUID MONOCRYSTAL OF THE NEMATIC TYPE. J.Falgueirettes.
Bull. Soc. Franc. Mineral. Crist., Vol. 82, No. 4-6, 171-200 (April-June, 1959). In French.

A liquid monocrystal of para-azoxyanisole was examined by X-ray diffraction, using monochromatized Cu K_α radiation. A pattern of arcs was obtained which was measured by a microphotometer. From the results a distribution function was worked out in terms of the angle between the molecular axes and the optic axis.
J.Thewlis

MECHANICS OF GASES
VACUUM TECHNIQUE

533.5 : 531.788

11908. A TILTING AIR-LUBRICATED PISTON GAGE FOR PRESSURES BELOW ONE-HALF INCH OF MERCURY. U.O.Hutton.
J.Res. Nat. Bur. Stand., Vol. 63C, No. 1, 47-57 (July-Sept., 1959).

A description is given of a tilting dead-weight piston gauge constructed at the National Bureau of Standards for ranges of differential pressure up to about 0.5 inch of mercury. A resolution of better than 1 part in a hundred thousand of full scale has been obtained by use of the toolmaker's sine bar method of angle measurement. The scale is a linear function of the sine. The instrument can be calibrated from basic measurements of length and weight, is rugged, and may be constructed in almost any laboratory mechanical shop. Sources of possible errors in reading are discussed in detail. Comparative tests with certain other gauges or manometers are cited wherein linearity was found to be within 1 part in 10 000 and agreement within 2 parts in 10 000. The uses of the gauge are briefly discussed.

533.5 : 531.788

11909. A NEW UNIVERSAL PORTABLE MASS SPECTROMETER FOR LEAK DETECTION. H.W.Drawin and K.Kronenberger.
Z. InstrumKde., Vol. 67, No. 6, 157-61 (June, 1959). In German.

A portable table mass spectrometer which was designed especially for the mass spectrometric leak detection on vacuum and pressure apparatus is described. It is suitable for the analysis of simple vapour- and gas-mixtures. Results of measurements obtained are given and the use of the apparatus for leak detection is described.

533.5 : 531.788.13

11910. HEAT TRANSFER IN THE ABSOLUTE MANOMETER. I.Pátý.
Naturwissenschaften, Vol. 46, No. 13, 422-3 (1959). In German.

The temperature of the vane in a Knudsen manometer has been found to increase in the course of a measurement. This temperature rise was almost independent of pressure for pressures below 10^{-4} mm Hg. The error in pressure determinations can amount to between 2 and 6%, when this temperature rise has not been taken into account.
R.Schnurmann

533.59

11911. CLEANING TECHNIQUES FOR RUBBER O-RINGS USED IN VACUUM SYSTEMS. J.R.Young.
Rev. sci. Instrum., Vol. 30, No. 4, 291 (April, 1959).

In a previous paper [Rev. sci. Instrum., Vol. 29, No. 9, 795-6 (1958)], it was reported that Neoprene rubber O-rings gave off methane under vacuum. The author discusses methods of reducing this outgassing to a minimum.
R.D.Hudson

533.6.011

11912. A NEW APPROACH TO THE THEORY OF SLENDER BODY IN COMPRESSIBLE FLOW. H.Moriguchi.
J. Phys. Soc. Japan, Vol. 13, No. 11, 1384-90 (Nov., 1958).

It is shown that the equation of perturbation given to a known two-dimensional or axisymmetric flow of a compressible fluid can be written in a simple form by choosing appropriate coordinates. From an approximate solution of this equation in the case of a slender body, a velocity transformation formula is deduced

$$\int_U^q \frac{\sqrt{1 - q^2/c^2}}{q} dq = \log (q/U)_i,$$

where q, c and U are the velocity of fluid at an arbitrary point on the surface of the body, the local velocity of sound and the velocity of free stream (the critical speed of sound being taken as the unit of velocity), and $(q/U)_i$ is the velocity of incompressible flow at the same point taking the velocity of free stream as unit.

MOLECULAR THEORY OF GASES

533.7

11913. TRANSPORT COEFFICIENTS AND FORCE BETWEEN UNLIKE MOLECULES. S.C.Saxena.
Indian J. Phys., Vol. 31, No. 3, 146-55 (March, 1957).

The binary viscosity, diffusion and thermal conductivity of binary gas mixtures are calculated, with a view to test the adequacy and appropriateness of the Lennard-Jones 12 : 6 model in representing the like and unlike interactions of the gaseous molecules. ϵ_{12}/k values determined from thermal diffusion are used and r_{12} is calculated by correlating these values with the theoretical relation developed by Srivastava and Madan (1953) connecting the force constants for like and unlike molecules. Fairly reasonable agreement is obtained between the observed and calculated values, which confirms the adequacy of the Lennard-Jones 12 : 6 model as well as the accuracy of the potential parameters.

533.7 : 541.124

11914. ON THE VELOCITY DISTRIBUTION IN A CHEMICALLY REACTING GAS. R.D.Present.
J. chem. Phys., Vol. 31, No. 3, 747-50 (Sept., 1959).

The departure of the velocity distribution function from the Maxwellian form and the corresponding correction to the reaction-rate formula have been calculated for a gas undergoing a slow bimolecular reaction. Kinetic theory methods based on the Boltzmann transport equation were used. This work differs from a previous calculation by Prigogine and Xhrouet (Abstr. 3844 of 1959) in two respects: (1) the energy dependence of the reaction cross-section is taken in a form that is consistent with the conventional simple collision theory (in the previous work this was not the case and the results are sensitive to this choice), and (2) a simplified derivation of the important formulae is given, following the original methods of Chapman based on the equations of change instead of the integral-equation techniques of Enskog. The calculations take into account the effect of the reaction in depleting the tail of the Maxwell distribution, but do not take into account the effects of the heat of reaction. It is found that when kT is one-fifth the activation energy, the reaction rate is 8% less than that predicted by the conventional simple collision theory.

533.72

11915. MOLECULAR DIFFUSION STUDIES IN GASES AT HIGH TEMPERATURE. III. RESULTS AND INTERPRETATION OF THE He—A SYSTEM. R.E.Walker and A.A.Westenberg.
J. chem. Phys., Vol. 31, No. 2, 519-22 (Aug., 1959).

For Pt II, see Abstr. 4351 (1959). Experimental measurements of the binary diffusion coefficient of He—A obtained by the point-source technique over the temperature interval 300°-1100°K are presented. The data include the extremes of the concentration dependence for D_{He-A} measured at 298°K. Interpretation is made in terms of a purely repulsive interaction between the atoms; the concentration dependence is included in the theoretical analysis. Comparison is made with the He—A interaction obtained from other sources. At the highest temperature, the measurements overlap the range of validity of diffusion coefficients predicted from the potential obtained by Amdur et al. (Abstr. 9637 of 1954) from small-angle scat-

tering experiments. Good agreement is shown to exist between the two types of experiments, which further substantiates the validity of predicting high-temperature transport properties from scattering potentials.

VIBRATIONS . ACOUSTICS

534.01

11916. THE DEFLECTION OF WAVES BY THE MOTION OF THE PROPAGATING MEDIA. A.Metz.
C.R. Acad. Sci. (Paris), Vol. 248, No. 11, 1615-17 (March 16, 1959). In French.

The deflection of waves at the interface between two media, one of which moves with velocity v relative to the other, is given by cosec i − cosec r = v/c, where c is the propagation velocity, supposed the same in the two media. This result is used to criticize Datzeff's modified ether drift hypothesis (Abstr. 9510 of 1957).
R.A.Newing

534.1 : 518.5

11917. THE PARALLEL-CIRCUIT EQUIVALENT OF MECHANICAL VIBRATIONS. J.J.Hupert.
Amer. J. Phys., Vol. 27, No. 6, 427-9 (Sept., 1959).

The usual method of treating electromechanical analogies is to consider a mechanical vibrating system of the type $f(t) = m(d^2x/dt^2) + \rho(dx/dt) + kx$ as a series electrical circuit of the type $e(t) = L(d^2q/dt^2) + r(dq/dt) + q/C$. Little use seems to be made of the corresponding parallel electrical circuit $I(d^2\phi/dt^2) + \rho(d\phi/dt) + k\phi = f(t)$. The analogous terms and equations for these two electrical circuits are described and the use of the parallel circuit method is illustrated by reference to a vibrating reed.
H.J.H.Starks

534.12

11918. THE CHANGE OF NATURAL FREQUENCIES OF MEMBRANES AND RESONATORS WITH ADDITIONAL LOADS. Yu.N.Dnestrovskii.
Akust. Zh., Vol. 4, No. 3, 244-52 (1958). In Russian.

The method of successive approximations is employed to study the variation of the natural values with magnitude and distribution of load. It is shown that even small loads concentrated in a small volume strongly affect the system, shifting the spectrum to the left. For large distributed loads the same happens. Using the method of perturbations a more accurate Rayleigh formula is obtained, appropriate to small loads. [English translation in: Soviet Physics—Acoustics (New York), Vol. 4, No. 3, 249-57 (July-Sept., 1958)].
C.R.S.Manders

534.2

11919. ON THE MEASUREMENT OF SHEAR-WAVE ATTENUATION USING A WATER TANK. K.V.Goncharov.
Akust. Zh., Vol. 5, No. 2, 244-5 (1959). In Russian.

Longitudinal waves produced by a radiator were transformed into shear waves by interaction with faces of a carefully shaped sample placed in a water tank. This method was used to study shear-wave attenuation in two magnesium alloys and fused quartz. This attenuation was found to rise steeply with frequency between 5 and 30 Mc/s in magnesium alloys, but in quartz it was a linear function of frequency between 5 and 75 Mc/s. These results indicate scattering on internal inhomogeneities in magnesium alloys and the absence of such scattering in fused quartz. Attenuation in quartz was mainly due to hysteresis losses. A.Tybulewicz

534.2

11920. TRANSFORMATION OF ACOUSTIC LONGITUDINAL WAVES INTO SHEAR OR TORSIONAL VIBRATIONS. M.G.Sirotyuk.
Akust. Zh., Vol. 5, No. 2, 254 (1959). In Russian.

Acoustic longitudinal waves are transformed by a device consisting of a metallic waveguide whose diameter is much smaller than the acoustic wavelength. This waveguide has a groove cut in it which deepens gradually and becomes a spiral. The separation between two turns of the spiral decreases smoothly so that at the end of the guide the groove cuts the plane end at a small angle. Applications of the device are briefly discussed. A.Tybulewicz

534.2

11921. THE PRINCIPLE OF RECIPROCITY IN ACOUSTICS. L.M.Lyamshev.
Dokl. Akad. Nauk SSSR, Vol. 125, No. 6, 1231-4 (April 21, 1959). In Russian.

Derives the mathematical formulation of the principle of reciprocity, describing the relationship between the volume sources in the acoustic medium, some external forces acting on the shells, membranes etc., and the radiation fields generated by these sources and bodies. F.Lachman

534.2

11922. EXPERIMENTAL INVESTIGATION OF THE PROPAGATION OF FINITE-AMPLITUDE SPHERICAL WAVES. E.V.Romanenko.
Akust. Zh., Vol. 5, No. 1, 101-5 (1959). In Russian.

Gives the design of the radiator and receiver and some results of an investigation of the propagation of waves with pulsed emission at f = 1.15 Mc/s and pressure amplitude at the surface of the radiator up to 26 atm. Satisfactory agreement is found between the theoretical and experimental results. A method is also given for determining the frequency characteristics of receivers, over a wide range of frequencies, based on the change of shape of a finite amplitude wave during propagation. C.R.S.Mander

534.2

11923. BENDING WAVE PROPAGATION IN MULTILAYER PLATES. G.Kurtze.
J. Acoust. Soc. Amer., Vol. 31, No. 9, 1183-201 (Sept., 1959).

Flexural wave propagation and damping in multilayer plates is treated theoretically with use of impedance techniques. These techniques yield equivalent electrical circuits whose behaviour is determined either by standard circuit analyses or by analogue electrical measurements. The properties of two types of multilayer damping treatments are investigated in detail. The first type is a two-plate system enclosing a viscous liquid. The viscous liquid may also contain pressure-release partitions. The second type investigated consists of a layer of an air-filled porous material placed between a plate to be damped and an array of masses. Flexural wave measurements carried out on these multiple plates are shown to be in good agreement with calculations. It is shown that the viscous liquid layer and the porous layer may have high loss tangents in particular frequency ranges. With the use of the impedance techniques, a comparison is made between the damping treatments studied and two other damping treatments that have been investigated earlier by Oberst and Kerwin.

534.2

11924. THE PROPAGATION OF PLANE, FINITE-AMPLITUDE SOUND WAVES IN A VISCOUS THERMOCONDUCTING MEDIUM. Z.A.Gol'dberg.
Akust. Zh., Vol. 5, No. 1, 118-20 (1959). In Russian.

The problem is to examine in Lagrange variables x and t the acoustic field set up for $x > 0$ by a plane vibrating about $x = 0$ along the x axis. Initial and boundary conditions (i) displacement of particles of the medium $u(x,t) = 0$ for $t \leq 0$; (ii) $u(0,t) = f(t) = a(1-\cos\omega t)$ for $t > 0$. In the analysis only waves flowing from the plane in a +ve x direction are considered, i.e. no reflection.
C.R.S.Mander

534.2

11925. DEPENDENCE OF THE GAIN COEFFICIENT OF A FOCUSING SYSTEM ON THE SOUND INTENSITY. K.A.Naugol'nykh and E.V.Romanenko.
Akust. Zh., Vol. 5, No. 2, 191-5 (1959). In Russian.

Lowering of the gain coefficient of focusing systems and radiators, due to non-linear distortions of the waveform, is discussed. A parameter is introduced which makes it possible to evaluate the effect of non-linear distortions on the gain coefficient of a focusing system. The theoretical results were checked by investigation of the waveform near the focus and of the gain coefficient of three focusing pulse radiators (working frequencies 0.5, 1.4 and 2.2 Mc/s made of ceramic barium titanate. The maximum pressure at the focus of one of these radiators was about 200 atm. At this pressure and under pulse conditions (100 μsec duration and 50 c/s repetition frequency) cavitation occurred at the focus. A.Tybulewicz

534.21 : 621.37

11926. RELATED EXPERIMENTS WITH SOUND WAVES AND ELECTROMAGNETIC WAVES. W.E.Kock.
Proc. Inst. Radio Engrs, Vol. 47, No. 7, 1192-201 (July, 1959).

Various analogue situations in acoustic and electromagnetic waves are described. Certain higher order modes of airborne sound waves in tubes possess a transverse or polarized nature, and electromagnetic properties such as cutoff effects, polarization

ration, and circular polarization can be shown for these sound waves. Externally guided sound waves, similar to radio waves guided by a dielectric rod, are also discussed, as are superdirective acoustic and electromagnetic arrays, space-frequency equivalence in arrays, and experiments in wave diffraction.

534.213

11927. CERTAIN PECULIARITIES OF THE MOTION OF MIXTURES. Ya.Z.Kleiman.
Akust. Zh., Vol. 5, No. 2, 157-65 (1959). In Russian.

Compression and rarefaction waves in a multi-component medium are discussed in the acoustic approximation. Separation of components may occur behind the wave-front, because of their different velocities. It is shown that, under certain conditions, a group of waves may appear in a mixture, the number of waves being equal to the number of components. The first wave (compression or rarefaction) in such a group is similar to a wave in a single-component medium. The other waves are characteristic of mixtures.
A.Tybulewicz

534.22 : 532.7

11928. APPARATUS FOR MEASURING THE VELOCITY OF ULTRASOUND IN LIQUID METALS.
I.I.Polotskii, V.F.Taborov and Z.L.Khodov.
Akust. Zh., Vol. 5, No. 2, 202-5 (1959). In Russian.

The velocity is deduced from the transit time of a short ultrasonic pulse through a layer of the liquid metal or alloy. The apparatus was used to find the ultrasound velocity in tin (2454 m/sec at 237° C), bismuth (1663 m/sec at 285° C), cadmium (2215 m/sec at 335° C) and lead (1834 m/sec at 340° C).
A.Tybulewicz

534.222.2

11929. ANALYTIC SOLUTIONS FOR THE BLAST-WAVE PROBLEM WITH AN ATMOSPHERE OF VARYING DENSITY. M.H.Rogers.
Astrophys. J., Vol. 125, No. 2, 478-93 (March, 1957).

The adiabatic motion of a gas behind an infinitely strong shock wave is examined in the case when the density of the gas ahead of the shock front varies as a power of the distance from the origin. It is found that if the decrease in density is greater than a certain critical value, a discontinuity occurs in the gas at some point behind the shock front, and cavitation appears. A complete investigations is made for the case of spherically symmetric flows, and the nature of the discontinuity is examined in each case.

534.222.2 : 537.525

11930. PROPAGATION OF NON-IONIZING SHOCK WAVES PRODUCED BY DISCHARGING A CONDENSER THROUGH A GAS-FILLED TUBE. R. Der Agobian and L.Lifschitz.
C.R. Acad. Sci. (Paris), Vol. 248, No. 19, 2734-6 (May 11, 1959). In French.

Propagation distance in neon was measured as a function of time for stored energies between 0.2 to 20 joules in discharges lasting from 1 to 5 μsec. The gas pressure was varied from 4.5 up to 150 mm Hg. The experimental data are compared with a formula given by Harris (U.S. Naval Research Laboratory Rep. 4854, 1956).
C.G.Morgan

534.222.2 : 530.12

11931. CONDITIONS FOR SHOCK WAVES ACCORDING TO THE GENERAL THEORY OF RELATIVITY. V.A.Skripkin.
Dokl. Akad. Nauk SSSR, Vol. 123, No. 5, 799-802 (1958). In Russian.

Conditions for excitation of shock waves in an ideal, compressible medium are formulated in terms of the general theory of relativity. It is shown that for a centrally-symmetrical field, the components of metric tensor of a 4-dimensional space remain continuous during the passage of a shock wave, while their derivatives are discontinuous. The conditions for first and second derivatives of the components of metric tensor are deduced for the shock wave.
J.K.Skwirzynski

534.222.2

11932. ON MODELLING THE MOTION OF A HEAVY RIGID BODY UNDER THE ACTION OF A SHOCK WAVE.
G.S.Grigoryan, A.G.Sokolov and Yu.I.Spasibukhov.
Dokl. Akad. Nauk SSSR, Vol. 124, No. 1, 48-50 (1959). In Russian.

The characteristic parameters of the motion of the natural system and of the model are identified and correlated on the basis of similarity and of the dimensional analysis. In particular it is found that the impulsive moments of the shock waves are proportional to the squares of the characteristic dimensions of the body or to the characteristic dimensions themselves, depending whether the body is in contact with the ground or not. Results of experiments with solid spheres are described.
J.K.Skwirzynski

534.222.2

11933. NOTE ON FINITE AMPLITUDE PROPAGATION EFFECTS ON SHOCK WAVE TRAVEL TIMES FROM EXPLOSIONS AT HIGH ALTITUDE. S.G.Reed, Jr.
J. Acoust. Soc. Amer., Vol. 31, No. 9, 1265 (Sept., 1959).

Consequences are given of taking into account energy loss, in addition to lengthening of the overpressure phase, of a weak shock wave travelling vertically downward in an exponentially stratified atmosphere.

534.222.2

11934. CYLINDRICAL SHOCK WAVES FROM EXPLODED WIRES OF HYDROGEN-CHARGED PALLADIUM. F.D.Bennett.
Phys. of Fluids, Vol. 2, No. 4, 470-1 (July-Aug., 1959).

Describes phenomena encountered in attempts to generate strong shock waves by the technique of Abstr. 1196 (1959), but using H_2 occluded in Pd as the driver gas, and in some cases plating the Pd with Cu or Au to prevent too-early escape of H_2.
J.Hawgood

534.222.2 : 531.571

11935. X-RAY METHOD FOR STUDY OF EXPLOSIVELY ACCELERATED METAL SYSTEMS USING A 7 MeV ELECTRON LINEAR ACCELERATOR.
W.N.Hess, M.D.Martin, G.C.McFarland, W.A.Rutz and J.A.Welch, Jr.
Rev. sci. Instrum., Vol. 30, No. 9, 794-9 (Sept., 1959).

X-rays from a 7 MeV electron linear accelerator operated with a pulse length of 10 μsec pass through the assembly under study and are detected by NaI scintillators viewed by photomultipliers. Collimation is used to achieve time resolution of 0.2 μsec and space resolution of 0.025 cm parallel to the direction of motion and 1 cm perpendicular to the motion.

534.222.2 : 541.126

11936. SIMULTANEOUS DETONATION ALONG A LINE.
J.O.Erkman.
Rev. sci. Instrum., Vol. 30, No. 9, 818-20 (Sept., 1959).

Some experiments for studying the effects of explosively induced shock waves require that the detonation front lie in a straight line in a thin sheet of explosive. Since explosives are conventionally point initiated, a device must be used to convert the curved detonation front into a straight front. This conversion has been achieved in a practical fashion by point initiating a thin sheet, properly shaped, of easily moulded explosive. Some satisfactory shapes which can be produced by standard shop methods are described.

534.222.2 : 532.5 : 538.3

11937. SHOCK WAVES IN A CONDUCTING ULTRARELATIVISTIC GAS. K.P.Stanyukovich.
Zh. eksper. teor. Fiz., Vol. 35, No. 2(8), 520-1 (Aug., 1958).
In Russian. English translation in: Soviet Physics—JETP (New York), Vol. 35(8), No. 2, 359-60 (Feb., 1959).

Pressure p, density ρ, specific volume V and entropy σ are assumed to be related by the equations $p = (k-1)\rho c^2$, $\rho V^k = \sigma^k$, and velocity is taken perpendicular to magnetic intensity. Conservation laws at a plane shock front are written down and various conditions for no shock wave are noted.
R.A.Newing

534.222.2 : 535.37

11938. PHYSICAL PHENOMENA OBSERVED DURING THE EXPANSION IN VACUUM OF BODIES COMPRESSED BY STRONG SHOCK WAVES. Ya.B.Zel'dovich and Yu.P.Raizer.
Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1402-6 (1958). In Russian.

The glow of an opaque, initially solid body appearing after compression of it by a strong shock wave with subsequent expansion in vacuum is studied. Condensation of vapour of the substance and recombination of ions and electrons under these conditions are also considered.

534.222.2

11939. CONVERGING CYLINDRICAL DETONATION WAVE.
Ya.B.Zel'dovich.
Zh. eksper. teor. Fiz., Vol. 36, No. 3, 782-92 (1959). In Russian.

The properties of detonation waves close to the normal detonation wave are considered. A theory of amplification of a cylindrical converging detonation wave is proposed which exactly describes the amplification during the start of the process. By comparison with numerical computations it is shown that the theory remains satisfactory for small radii and appreciable amplification of the wave.

534.23

11940. REVERBERATION TANK METHOD FOR INVESTIGATION OF SOUND ABSORPTION IN THE SEA. V.P.Glotov.
Akust. Zh., Vol. 4, No. 3, 239-43 (1958). In Russian.

A ship tank installation is described and also the method of using it for the local investigation of sound absorption in the sea at various depths. Results are given for a study undertaken at frequencies 15-18 kc/s. [English translation in: Soviet Physics—Acoustics (New York), Vol. 4, No. 3, 243-8 (July-Sept., 1958)].
C.R.S.Manders

534.23

11941. ABSORPTION OF SOUND UNDER WATER BY WEDGES. M.S.Narayanan.
J. Instn Telecomm. Engrs. (New Delhi), Vol. 5, No. 2, 89-92 (March, 1959).

The sound-absorbing properties of a porous material, in the form of wedge-shaped ribs, are studied using 1 μsec pulses with a repetition frequency of 50 p/s. The results cannot be quantitative because of the effect of reflections from the tank walls, but they can be used for comparing various sizes and spacings of ribs.
V.G.Welsby

534.23

11942. OSCILLATORY MAGNETO-ACOUSTIC EFFECT IN METALS. T.Kjeldaas, Jr and T.Holstein.
Phys. Rev. Letters, Vol. 2, No. 8, 340-1 (April 15, 1959).

An account is given of the results of a calculation of ultrasonic absorption by electrons in metals in the presence of a magnetic field transverse to the direction of propagation of the sound. The cases considered are (a) longitudinal sound waves (b) shear waves with field perpendicular to vibrations. The method is similar to that of Rodriguez (Abstr. 4387 of 1959) but certain additional terms in an expansion are now considered and this produces the oscillatory behaviour of the absorption with field, such as is observed and for which Rodriguez could not account. The results are presented graphically for ql = 3,7,11 and 15 (where q is the magnitude of the wave-vector and l is the electron mean free path), and it is shown that the oscillations are not to be expected for $ql \leq$ just over 3. Another assumption made by Rodriguez is also felt to be incorrect and correction of this produces a different high-field behaviour of the absorption.
L.Mackinnon

534.23

11943. ATTENUATION OF ULTRASONIC WAVES IN SUSPENSIONS OF VISCOELASTIC SPHERES. Y.Wada.
J. Phys. Soc. Japan, Vol. 13, No. 11, 1390-8 (Nov., 1958).

The attenuation of ultrasonic waves for suspensions of polymethyl methacrylate particles (mean radius $a \cong 40$ μ) in ethyl alcohol, carbon tetrachloride and their mixtures were measured in the frequency range 1-6 Mc/s. For $ka > 0.5$ ($k = 2\pi/$wavelength) the scattering and reflection losses are found to be predominant origins of the attenuation. But when ka approaches unity, the observed attenuation lies markedly below the prediction from Rayleigh's formula which is established under the condition of $ka \ll 1$. For $ka < 0.5$, the viscous loss predicted by Lamb and Urick and the loss due to the internal viscosity of the suspended particles become appreciable. A simple theory for the latter loss is developed. The sum of the theoretical values of the three kinds of losses is in satisfactory agreement with the experimental one. In the frequency range where the internal loss predominates, this method can be used to measure the volume viscosity of a solid material.

534.23

11944. MAGNETIC OSCILLATIONS OF ULTRASONIC ATTENUATION IN A COPPER CRYSTAL AT LOW TEMPERATURES. R.W.Morse and J.D.Gavenda.
Phys. Rev. Letters, Vol. 2, No. 6, 250-2 (March 15, 1959).

Measurements were made between 15 and 75 Mc/s, in fields H up to 6.5 kG, at 4° K. For longitudinal waves propagated along (001), with H // (100), about seven maxima in attenuation are found, accurately periodic in 1/H, and corresponding to an electron momentum of 1.16×10^{-19} g cm sec^{-1}. With H // (110), a different and more complex pattern is found, in qualitative agreement with the model proposed for Cu by Pippard (Abstr. 2651 of 1958). The high field attenuation also shows strong anisotropy.
R.G.Chambers

534.231

11945. AN ASYMPTOTIC REPRESENTATION OF THE ACOUSTIC FIELD OF A POINT SOURCE IN A WEDGE-SHAPED REGION. M.P.Sakharova.
Akust. Zh., Vol. 5, No. 2, 215-20 (1959). In Russian.

An asymptotic representation is obtained for the acoustic field of a point source in a wedge-shaped region with either perfectly soft or perfectly hard boundaries. The representation applies at large distances from the source, and it is convenient for numerical calculations in the case of small-angle wedges. It is shown that the acoustic field in the region of geometrical shadow decreases with increase of distance along the wedge edge according to a power law in which the exponent depends only on the wedge angle.
A.Tybulewicz

534.231

11946. THE FIELD OF A POINT RADIATOR IN THE LAYER LYING IN A SEMISPACE. Yu.L.Gazaryan.
Akust. Zh., Vol. 4, No. 3, 233-8 (1958). In Russian. English translation in: Soviet Physics—Acoustics (New York), Vol. 4, No. 3, 237-42 (July-Sept., 1958).

The frequency variation of the field of a lateral wave is studied when there is total reflection, at frequencies close to the critical frequency of one of the normal waves. Under these conditions the field is found to vary markedly with frequency. Properties of normal waves were considered in detail in "Propagation of Sound in the Ocean" — K.Pekeris, Moscow, 1951.
C.R.S.Manders

534.231

11947. DISTRIBUTION OF SOUND PRESSURE IN A SINUSOIDAL ULTRASONIC FIELD EMITTED BY A CIRCULAR QUARTZ DISK VIBRATING AS A PISTON. N.Ségard and J.Cassette.
Ann. Soc. Sci. Bruxelles I, Vol. 72, No. 3, 185-91 (1958). In French

Theoretical and experimental study of the field near the axis leads to conclusions disagreeing with those of Seki et al (Abstr. 3579 of 1956).
H.D.Parbrook

534.231

11948. ON THE ACOUSTIC FIELD BY A VIBRATING SOURCE ARBITRARILY DISTRIBUTED ON A RIBBON PLATE. I. N.Kawai.
J. Phys. Soc. Japan, Vol. 13, No. 11, 1374-84 (Nov., 1958).

Two-dimensional rigorous solutions are presented for the acoustic field in the air caused by the vibrating source arbitrarily distributed on an infintely thin and infintely long ribbon. Using rectangular coordinates, a unique solution satisfying the boundary condition is obtained by the method of expansion in hypergeometric polynomials. The expression for the velocity potential at large distance, pressure on the ribbon plate and power of radiation are obtained as a function of $k = 2\pi a/\lambda$, where a is the half-breadth of the plate and λ is the wave length.

534.232

11949. KUNDT'S TUBE MEASUREMENTS OF THE WAVELENGTHS OF ULTRASONIC VIBRATIONS GENERATED BY A JET. P.N.Kubanskii.
Akust. Zh., Vol. 5, No. 2, 252-3 (1959). In Russian.

Kling and Crabol (1949) reported that a jet of air produces ultrasonic vibrations whose frequencies lie between 50 and 400 kc/s. This effect is observed in jets issuing from nozzles at supersonic and subsonic velocities. The vibration frequency depends on the nozzle diameter and the air pressure at the nozzle; this frequency decreases with increase of the latter two quantities. The present note describes Kundt's tube measurements of the frequencies generated by jets produced by nozzles of diameters 0.5, 2.0, 5.0 and 9 mm. Detailed results are quoted for the 2 mm nozzle working at pressures from 0.1 to 2.5 kg/cm^2. The emitted sound was of 4.5-5.5 mm wavelength, corresponding to 75.5-61.8 kc/s.
A.Tybulewic

534.23

11950. THE ACOUSTIC RECTIFIER — AN ELEMENT DEPENDENT ON DIRECTION. L.X.Nepomuceno.
An. Acad. Brasil. Cienc., Vol. 31, No. 1, 37-48 (1959). In German.

The author describes an acoustic equivalent of an electrical half-wave rectifier. The device consists in principle of a number of rows of thin-walled half-cylinders with the convex sides facing the incident sound, the rear concave sides being on the side remote from the sound. The aerodynamic resistance of this arrangement is small on the incident (convex) surface, and large in the opposite direction on the rear (concave) surface, the ratio being of the order of 30 dB. When such a system of half cylinders is mounted in front of an enclosure, the incident sound is rectified and builds up a stati pressure. Illustrations are given of this acoustic rectifier, having different spacings between individual tubes and between the various

ks of tubes (up to five). The half-tubes used in the investigation a diameter of 10 mm and showed resonance effects in the region 20 kc/s. A.B.Wood

534.232

1951. RELATION, FOR HIGH VELOCITY AIR JETS, BETWEEN E SHAPE, DIMENSIONS OF THE ORIFICE AND THE NATURE THE ACOUSTIC RADIATION. F.Canac and M.Merle.
R. Acad. Sci. (Paris), Vol. 248, No. 13, 1953-4 (April 1, 1959). In French.

Experiments showed that, with increasing pressure ratio, the discrete frequency acoustic radiation ceases (a) for a rectangular jet when the half wavelength equals the major dimension of the orifice, (b) for a circular jet, when the wavelength in each domain approximately equals an integral number of diameters.
H.D.Parbrook

534.232

1952. REPLY TO "CALIBRATION OF TWO TRANSDUCERS ASSUMED IDENTICAL". A.F.Niemoeller.
J. Acoust. Soc. Amer., Vol. 31, No. 6, 814 (June, 1959).

Amendments to two equations in a previous paper (Abstr. 9335 of 1959) are proposed. H.D.Parbrook

534.232

1953. PIEZOELECTRIC PRODUCTION OF MICROWAVE PHONONS. E.H.Jacobsen.
Phys. Rev. Letters, Vol. 2, No. 6, 249-50 (March 15, 1959).

Two tuned re-entrant microwave cavities coupled by a quartz rod were immersed in a liquid helium bath. One cavity was fed with microwave energy at 9370 Mc/s, which produced elastic waves in the rod. At the receiver cavity, part of the energy produced a radio-frequency signal and part was reflected. Successive reflections produced a series of echo pulses about 11 μsec apart. The decay curve of the echo pulses showed variations from a simple exponential curve, probably because of partial coupling to other elastic modes. The average attenuation increased more than linearly with temperature and at 77° K no ultrasonic wave propagation was observable.
R.C.Kell

534.25

1954. A NEW METHOD OF SOLVING THE PROBLEM OF THE ACOUSTIC FIELD IN A LIQUID WEDGE. V.K.Kuznetsov.
Akust. Zh., Vol. 5, No. 2, 170-5 (1959). In Russian.

A new approach is made to calculation of the acoustic field in a liquid wedge with perfectly reflecting boundaries. The theory predicts, inter alia, refraction of normal waves in the wedge and this refraction may explain certain anomalous results reported by several workers. A.Tybulewicz

534.26

1955. CALCULATION OF DIFFRACTION OF A CONVERGING CYLINDRICAL [ACOUSTIC] WAVE ON A [INFINITE] CYLINDER. M.Kanevskii.
Akust. Zh., Vol. 5, No. 2, 151-6 (1959). In Russian.

The cylinder is coaxial with the wave-front. An expression is obtained for the resulting field, as well as an asymptotic expression for the intensity of the scattered wave and the effective scattering cross-section. The present case is compared with scattering of a plane wave on a cylinder whose perimeter is small compared with the incident wavelength. A.Tybulewicz

534.26

1956. ON THE DIFFUSION OF SOUND WAVES IN A TURBULENT ATMOSPHERE. R.H.Lyon.
J. Acoust. Soc. Amer., Vol. 31, No. 9, 1176-82 (Sept., 1959).

The directional and frequency diffusion of a plane monochromatic sound wave in statistically homogeneous, isotropic, and stationary turbulence is analysed theoretically. The treatment is based on the diffusion equation for the energy density of sound waves, using the scattering cross-section derived by Kraichnan for the type of turbulence assumed here. A form for the frequency wave number spectrum of the turbulence is adopted which contains some pertinent parameters of the flow and is adapted to ease of calculation. It is expected that the assumed spectrum is unrealistic at larger wave numbers. A new approach to the evaluation of the characteristic period of the flow is suggested. This spectrum is then related to the scattering cross-section. Finally, a diffusion equation is derived as a small-angle scattering approximation to the rigorous transport equation. The rate of spread of the incident wave in frequency and direction is calculated as well as the power spectrum and autocorrelation functions for the wave.

534.26

11957. SCATTERING OF IMPULSIVE ELASTIC WAVES BY A RIGID CYLINDER. F.Gilbert and L.Knopoff.
J. Acoust. Soc. Amer., Vol. 31, No. 9, 1169-75 (Sept., 1959).

The exact solution to the problem of the scattering of compressional elastic waves from a line source by a rigid, infinitely dense cylinder imbedded in an isotropic, homogeneous, perfectly elastic medium is obtained in integral form. The integrals are evaluated asymptotically to obtain the motions on the wave fronts. In the illuminated zone the saddle point method of integration yields the geometrical optics approximation to the reflected field. In the shadow zone the diffracted field is obtained by evaluating the integrals by the method of Dougall and Watson. In the case of an incident P wave the observed events in the illuminated zone are (1) direct P, (2) reflected P, and (3) reflected S. In the shadow zone the observed events are (1) diffracted P and (2) diffracted S. Both diffracted wave fronts travel around the cylinder with the velocity of P waves.

534.26

11958. SCATTERING OF HIGH FREQUENCY SOUND WAVES IN POLYCRYSTALLINE MATERIALS. II. A.B.Bhatia and R.A.Moore.
J. Acoust. Soc. Amer., Vol. 31, No. 8, 1140-1 (Aug., 1959).

The calculations of a previous paper (see Abstr. 2179 of 1959), which were based on a simplification in that the effective elastic properties of each grain were described by just Lamé's two elastic constants, are generalized to take into account the fact that an elastically anisotropic medium has actually several independent elastic constants. The final expressions for the attenuation coefficient of shear and dilatational waves exhibit qualitatively similar features as the corresponding expressions of the previous paper but differ quantitatively from them.

534.26 : 538.566

11959. MULTIPLE SCATTERING BY A RANDOM STACK OF DIELECTRIC SLABS. I.Kay and R.A.Silverman.
Nuovo Cimento Suppl., Vol. 9, No. 2, 626-45 (1958).

The scattering of incident plane waves in one dimension is considered theoretically. It is found that when the number of slabs is large, the Neumann series for the mean square transmission and reflection coefficients converge much more rapidly than would be inferred from the smallness of the perturbation of the incident field by the scattering medium, but that the randomness of the scattering medium is no longer effective in reducing multiple scattering when the order of the scattering exceed the number of slabs in the stack. The qualitative conclusions are believed to be generally valid also for three-dimensional scattering and more complicated scattering media. R.C.Glass

534.26 : 538.566

SCATTERING OF SCALAR WAVES BY A PARABOLOID. See Abstr. 11287

534.39 : 541.182

11960. ON THE ROLE OF TURBULENCE IN THE PHENOMENON OF ACOUSTIC COAGULATION OF AEROSOLS.
V.A.Gudemchuk, B.F.Podoshevnikov and B.D.Tartakovskii.
Akust. Zh., Vol. 5, No. 2, 246 (1959). In Russian.

Turbulence was found to play an important role in the coagulation of dioctylphthalate by 13 kc/s acoustic waves. This is probably due to the mixing of aerosol particles by eddies. A.Tybulewicz

534.39

11961. STREAMS CAUSED BY SOUND [WAVES].
K.A.Naugol'nykh.
Dokl. Akad. Nauk SSSR, Vol. 123, No. 6, 1003-5 (Dec. 21, 1958). In Russian.

Theoretical analysis of the acoustic stream at $Re > \sim 1$, caused by a serrate wave. Some results of the analysis agree with those obtained by Eckart (Abstr. 1180 of 1948). F.Lachman

534.39

11962. ULTRASONIC VIBRATION POTENTIALS IN NON-IONIC LIQUIDS. E.Yeager, J.Booker and F.Hovorka.
Proc. Phys. Soc., Vol. 73, Pt 4, 690-2 (April, 1959).

The potentials developed on a single platinum probe in water, 0.01 M KCl, and a number of organic liquids during the transmission of ultrasonic waves are observed to depend on whether or not the supporting glass mount of the probe is in or out of the liquid. When it is out of the liquid the potential is zero except in the case of the KCl solution for which a potential is found not significantly different from that found when the glass mount is partly in the liquid.
W.Good

534.44

11963. RULES FOR THE DETERMINATION OF THE FREQUENCY SPECTRUM OF DOUBLE-TONE POWER SERIES. W.Grahnert.
Hochfrequenztech. u. ElektAkust., Vol. 67, No. 1, 4-18 (July, 1958). In German.

A mathematical treatment of the double-tone power series leads to a nomographic method for determining the frequency spectrum for two special cases that are important in technology and forms the basis of the modulation and difference tone factor methods for the measurement of non-linear quantities. H.J.H.Starks

534.612

11964. PIEZOELECTRIC QUARTZ PROBE CONSTRUCTED TO MEASURE ULTRASOUND PRESSURE AND TO STUDY AN ULTRASOUND FIELD. N.Ségard, J.Cassette and F.Cocquerez.
Ann. Soc. Sci. Bruxelles I, Vol. 72, No. 3, 179-84 (1958). In French.

A quartz crystal (1 cm^2 area) and cathode follower mounted in a probe were used for measurements in liquids. H.D.Parbrook

534.612

11965. CONDENSER MICROPHONES WITH PLASTIC DIAPHRAGMS FOR AIRBORNE ULTRASONICS. I.
K.Matsuzawa.
J. Phys. Soc. Japan, Vol. 13, No. 12, 1533-43 (Dec., 1958).

A study is made of various condenser microphones, each of which consists of a metallic back plate and a thin plastic film stretched over the back plate, being in direct touch with it at a number of points. The surface of the back plate was roughened or provided with grooves, hollows or holes, while the external surface of the plastic film was made conductive by metallizing. The microphones were calibrated in the frequency range 1.5-150 kc/s. A fair agreement is found between the classifications of the back plates according to the mechanical roughnesses of the surfaces and the classifications based upon the frequency responses of the microphones. It is shown that the microphones with the back plates having finely roughened surfaces can be considered as single resonance systems. Detailed data are given, with which a microphone having a flat frequency response up to a desired high-frequency below 150 kc/s can be easily constructed.

534.614

11966. TRANSISTORIZED VELOCIMETER FOR MEASURING THE SPEED OF SOUND IN THE SEA. C.E.Tschiegg and E.E.Hays.
J. Acoust. Soc. Amer., Vol. 31, No. 7, 1038-9 (July, 1959).

An instrument of the "sing around" type is briefly described. Measured velocities in sea water at depths down to 760 fathoms are quoted. H.D.Parbrook

534.63

11967. THE POSSIBILITY OF STUDYING THE FREQUENCY SENSITIVITY CHARACTERISTICS OF TRANSDUCERS BY A SPECTRUM ANALYSIS OF THEIR THERMAL NOISE.
K.V.Goncharov.
Akust. Zh., Vol. 5, No. 1, 120-2 (1959). In Russian.

The thermal noise spectrum of a transducer was measured in a tank using an analyser of Voyutskii type [Radiotekhnika, Vol. 7, No. 6, 3-9 (1954)]. The apparatus is automatic in operation. Frequency characteristics are given for three cylindrical barium titanate hydrophones calculated from the thermal noise measurements and these are in good agreement with those of the reciprocity method. It is shown that the efficiency of the apparatus can also be determined from the measurements. C.R.S.Manders

534.7

PHYSIOLOGICAL ACOUSTICS. HEARING. See also the Section entitled "BIOPHYSICS. PHYSIOLOGICAL PHYSICS".

534.76 : 621.395.625

11968. LISTENER REACTION TO STEREOPHONIC REPRODUCTION BY REFLECTED SOUND.
S.E.Levy, G.W.Sioles, V.Brociner and R.W.Carlisle.
J. Acoust. Soc. Amer., Vol. 31, No. 9, 1256-9 (Sept., 1959).

Comparisons were made by numerous observers of the stereophonic perception of direct v. reflected sound. For conventional direct sound, two loudspeakers having wide frequency response were used at spacings of from 6 to 15 ft, directed towards the listeners. For reflected sound, equivalent dual sound sources were used placed back-to-back near the walls of a room in which it was desired to establish a stereophonic sound field. The frequency response of the latter system was equalized to have the same apparent response as the conventional system. Many of the tests were conducted behind a sound permeable screen. Listeners were mixed in their ability to identify the reflective system and in their preference for one system over the other, although they reacted favourably to both systems.

534.78

11969. RELATIVE OCCURRENCE OF PHONEMES IN AMERICAN ENGLISH. J.V.Tobias.
J. Acoust. Soc. Amer., Vol. 31, No. 5, 631 (May, 1959).

The word lists based on adult telephone conversations and previously analysed by French, Carter and Koenig [(Abstr. 1826B of 1930; Bell Syst. tech. J., Vol. 9, 290-324 (April, 1930)], were retranscribed using a modern dictionary of American English. Only small modifications to the previous list are reported. H.D.Parbrook

534.78

11970. LOW-FREQUENCY NOISE AND METHODS FOR CALCULATING SPEECH INTELLIGIBILITY. J.M.Pickett.
J. Acoust. Soc. Amer., Vol. 31, No. 9, 1259-63 (Sept., 1959).

Speech intelligibility was tested in a low-frequency masking noise. Various conditions of speech and noise filtering below 1200 c/s were employed in order to test the relative effects of direct low-frequency masking and upward spread of masking to higher frequency regions. Tests were carried out at three noise spectrum levels which corresponded to overall unfiltered levels of 85, 105, and 115 dB. The results showed significant decreases in intelligibility as the noise energy was admitted progressively between 300 and 20 c/s. Further, the speech frequencies between 20 and 300 c/s provided no significant contribution to intelligibility under any noise condition tested. It is therefore, concluded that the low frequency energy in the noise produced upward spread of masking. This interpretation is reinforced by the fact that spread of masking was greater at higher noise levels and also at lower speech-to-noise ratios. Implications for calculating the effects of noise interference upon intelligibility are discussed.

534.79

11971. LOUDNESS LEVELS, LOUDNESS RATIOS AND LOUDNESS SUMMATION. R.Feldtkeller, E.Zwicker and E.Port.
Frequenz, Vol. 13, No. 4, 108-17 (April, 1959). In German.

Describes an investigation into the relationship between "loudness levels" (phons) and "loudness" (sones). A comparison is made between these two loudness scales using methods of loudness summation, i.e. double and half loudness estimation. The standard sound used, at a frequency of 1 kc/s has a bandwidth of 160 c/s. After a discussion on the loudness of machinery noise, methods of measuring sones (loudness units) are discussed. A comparison is made between measured loudness for various summation tones. The authors conclude as a result of their measurements that a "loudness level" of a noise of 80 phons can correspond to a "loudness" between 4 and 30 sones. Such differences occur at large loudness levels. A.B.Wood

534.83

11972. A SHORT REVIEW OF THE WORK ON NOISE AND NOISE CONTROL CARRIED OUT IN USSR UP TO 1957. I.I.Slavin.
Akust. Zh., Vol. 5, No. 2, 221-30 (1959). In Russian.

Harmful effects of acoustic noise and methods of noise control are briefly discussed. This is followed by a short account of Russian 19th century work, done mainly by doctors. The rest of the paper in effect, is, an annotated bibliography of work carried out mainly between 1930 and 1957, including the author's own contribution. 73 Russian references. A.Tybulewicz

534.83

11973. CONSIDERATIONS CONCERNING AN UPPER LIMIT TO JET NOISE REDUCTION. A.Powell.
J. Acoust. Soc. Amer., Vol. 31, No. 8, 1138 (Aug., 1959).

The idea of a theoretical upper limit on jet noise reduction was put forward by Dyer, Franken and Westervelt (Abstr. 1219 of 1959). This is simpler than the question of determining what might be the reductions achieved in practice. In the present paper the authors extend the arguments advanced by Dyer et al. and quote experiment results in support of their theories. A.B.Woo

534.83

11974. ATTENUATION AND REGENERATION OF SOUND IN DUCTS AND JET DIFFUSERS. U.Ingard.
J. Acoust. Soc. Amer., Vol. 31, No. 9, 1202-12 (Sept., 1959).

The effect of noise regeneration by fluid flow on the performa

oise-attenuating structures is examined with special attention to ler design. The insertion loss of a single element, as well as a inuous distribution of attenuating and noise-regenerating ele- nts, is studied. For example, in a duct with an attenuation stant β per unit length and a regeneration r per unit length, upper limit of the insertion loss is 10 log $(2E\beta/r)$, where E is source strength. It should be noted that the insertion loss of a e-regenerating attenuator depends on the sound level to be ced. An analysis of experimental data on jet noise indicates the power spectrum of a circular jet depends on frequency, f, Mach number, M, approximately as f^2M^5 at low frequencies, as $M^{9.5}$ at high frequencies, and as M^7 at the peak frequency. In ns of the corresponding jet spectrum, for which an empirical lytical expression is given, the maximum attainable insertion of a jet muffler diffuser is presented as a function of frequency. deviation of the characteristics of a "lossy" diffuser from this er limit depends on the attenuation and regeneration characteris- of the acoustical elements in the muffler. These characteris- are investigated for the special element consisting of a perforated et, and the results are applied to an analysis of the insertion loss muffler diffuser of the perforated basket type.

534.845

11975. INVESTIGATION OF THE SOUND ABSORPTION COEFFICIENTS IN REVERBERATION ROOMS. E.Steffen.
Hochfrequenztech. u. ElektAkust., Vol. 67, No. 3, 73-7 (Nov., 1958). In German.

The arrangement, form and size of the material specimens have a strong influence on the sound absorption coefficient measured in a reverberation room. These factors were investigated in a model reverberation room. After discussing the theoretical aspect the paper gives experimental observations in a series of curves showing the effects of arrangement of the specimen in the room (i.e. relative positions), and the form of the specimen (in one piece or in several pieces). A.B.Wood

OPTICS . SPECTRA . LUMINESCENCE

535.1

11976. CONCERNING THE PROPAGATION OF LIGHT IN HETEROGENEOUS ISOTROPIC MEDIA. M.Azpiroz Yoldi.
An. Real Soc. Espan. Fis. Quim., Vol. 55A, No. 5-6, 143-8 (May-June, 1959). In Spanish.

Some general physical properties of light propagation are briefly discussed. A method is given whereby the curvature and torsion of light rays are quickly obtained. The formulae found determine completely the deformation of the wave-fronts along the light trajectories.

535.12 : 535.32

11977. GROUP VELOCITY AND ENERGY (OR PARTICLE) FLOW DENSITY OF WAVES IN A PERIODIC MEDIUM. E.H.Wagner.
Acta cryst., Vol. 12, Pt 4, 345-6 (April, 1959).

The identity of direction of the Poynting vector and the normal to the dispersion surface, shown by Kato [Acta cryst., Vol. 11, 12, 885 (Dec., 1958)] is shown to arise from a result obtained by Peierls (Abstr. 2815 of 1929) on group velocity of waves in a crystal. A.R.Stokes

535.13 : 530.12

11978. COVARIANT GENERALIZATION OF THE STOKES PARAMETERS. R.Bourret.
J. Opt. Soc. Amer., Vol. 49, No. 10, 1002-3 (Oct., 1959).

A generalization of the classical Stokes parameters, along the lines suggested by Wolf (see Abstr. 1653 of 1955), is given. It consists of four complex space-time correlation functions of different components of the electromagnetic field. These functions satisfy field equations identical in form to Maxwell's equations. Transformation properties are simple and are given for spatial rotations and for Lorentz transformations.

535.22 : 536.566

A NEW DETERMINATION OF THE FREE-SPACE VELOCITY OF ELECTROMAGNETIC WAVES. See Abstr. 11286

535.222

11979. A NEW ARRANGEMENT FOR DETERMINATION OF THE VELOCITY OF LIGHT. A.Karolus and D.Fries.
Ann. Phys. (Liepzig), Folge 7, Vol. 4, No. 1-5, 269-82 (1959). In German.

In the arrangement described, the light is modulated by a field of two high-frequency ultrasonic waves. The arrangement otherwise resembles that of Anderson, but Anderson's Kerr-cell modulation is replaced by this new method. The modulation frequency 16 000 Mc/s is maintained to within 1 in 10^8. A multiplier tube is used as detector. With the new method the velocity is found to within an accuracy of 3 km/s with an 18 m path length. S.Tolansky

535.224

11980. NOTE ON THE VELOCITY OF LIGHT.
R.A.Miller and A.Lopez.
J. Opt. Soc. Amer., Vol. 49, No. 9, 930 (Sept., 1959).

It is argued that the time taken for reflection from a mirror surface may cause systematic errors in velocity determinations by optical methods. E.A.Mussett

535.241 : 535.232

11981. ON THE RELATIVE SPECTRAL ENERGY DISTRIBUTION OF CIE STANDARD SOURCE A. H.Wright.
J. Opt. Soc. Amer., Vol. 49, No. 10, 980-2 (Oct., 1959).

The relative spectral energy distribution of a tungsten ribbon filament lamp calibrated at 2854° K (C_2 = 14 380) differs from that of a coiled filament type lamp operating at the same colour temperature. There is reason to believe that the relative spectral energy distribution of the latter resembles more closely the relative spectral energy distribution tabulated by the CIE for that source and, consequently, lamps of the coiled filament type have been recommended for use as the standard. It has been shown theoretically that the difference between the two sources causes discrepancies in the chromaticities of certain test colours and it follows that the chromaticity coordinates of samples obtained by using the coiled filament lamp should be nearer the true values. The present paper describes an experiment in which ribbon and coiled filament lamps calibrated at 2854° K were subjected to visual and photoelectric tests to determine the significance of the effect of the different energy distributions on selected test colours. An analysis of the results shows that small changes in chromaticity do occur, but for practical colorimetric purposes these differences can safely be ignored.

535.242.43 : 537.312.5 : 621.383

11982. APPARATUS FOR CHECKING THE PROPORTIONALITY OF RESPONSE OF PHYSICAL RECEPTORS OF RADIATION.
H.Hoppmann.
Tech. wiss. Abhandl. Osram-Gesell., Vol. 7, 306-12 (1958). In German.

Describes apparatus for determining the linearity of a receptor such as a photocell. A diffusing window in a box containing a lamp and condenser system is covered with a set of removable sectors, so that the area exposed can be changed in 15 equal steps. J.W.T.Walsh

535.313

11983. TWO-STEP METHOD FOR PRODUCING REPLICA MIRRORS WITH EPOXY RESINS.
A.P.Bradford, W.W.Erbe and G.Hass.
J. Opt. Soc. Amer., Vol. 49, No. 10, 990-1 (Oct., 1959).

The paper describes a method for preparing plastic replicas of any existing mirror without using a negative glass master. In this two-step process a SiO-coated epoxy negative master is first prepared from the original mirror. This negative master is then used to produce plastic replicas which duplicate the original mirror. Epon 828 resin and Curing Agent C1 (meta phenylene diamine) were used to prepare the backing of the negative master and the final mirrors. A great number of f/1 to f/2 paraboloidal replicas was prepared by this method and compared optically with the original mirrors. The accuracy of the mirrors was tested by focusing incident collimated light on small pinhole apertures of various sizes and measuring the ratio of the light transmitted through the apertures to the total amount of light in the focal plane. With the mirrors used for reproduction, it was found that the replicas were, within the range tested (down to 0.18 mm aperture size), as accurate as the original glass mirrors. Plastic replica mirrors can be cleaned repeatedly without damage and have been transferred directly from dry ice to boiling water without breaking or changing their appearance.

535.315 : 535.33.07

11984. ON THE THEORETICAL RESOLUTION LIMIT OF PRISMS. J.Junkes.
Naturwissenschaften, Vol. 46, No. 12, 396-7 (1959). In German.

If the absorption of a prism is taken into account the spectrum line profile is broadened and the classical resolution formula must be replaced by one involving the absorption coefficient k. It is shown that for given k there is a prism base length which gives maximum resolution. For example for a flint prism with k = 0.10 the optimum base is 120 cm. W.T.Welford

535.317

11985. ON A QUASI-SYMMETRICAL REFLECTING OBJECTIVE. M.Gaj.
Optik, Vol. 16, No. 4, 234-44 (April, 1959). In German.

A study of the primary aberrations of a system consisting of two opposed menisci followed by a concave mirror. Graphs are given to show the effect of changing the stop position on the off-axis aberrations when the curvatures are chosen to give small spherical aberration. W.T.Welford

535.317.4

11986. PRINCIPLES OF THE THEORY OF THERMO-OPTICAL ABERRATIONS. III. THERMO-OPTICAL ABERRATIONS OF SYSTEMS CONSISTING OF THIN COMPONENTS. D.S.Volosov.
Optika i Spektrosk., Vol. 5, No. 2, 191-9 (1958). In Russian.
English summary: PB 141047T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

For Pts I and II see Abstr. 10730-1 (1959). The paper uses previous results to calculate the aberrations of a compound system in terms of the aberrations of its components. The result is applied to the case of a two-component system, either separated or in contact. R.W.Fish

535.323

11987. THE INFRARED DISPERSION OF SULPHIDES AND SELENIDES OF CERTAIN METALS. M.T.Kostyshin.
Optika i Spektrosk., Vol. 5, No. 1, 71-7 (1958). In Russian. English summary: PB 141047T-6, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Refractive indices (n) were determined from observations of interference fringes from thin films evaporated on to CaF_2 etc. Curves of n,λ for the range 0.6-9 μ are given for PbSe, $SnSe_2$, SnSe, CdS, CdSe, As_2S_3, As_2Se_3, Sb_2S_3 and Sb_2Se_3; and for Se in the range 0.6-14 μ. G.F.Lothian

535.326

11988. THE METHOD OF THE LUMINOUS POINT. II. STRIOSCOPY. I.V.Obreimov.
Optika i Spektrosk., Vol. 4, No. 5, 658-62 (1958). In Russian.
English summary: PB 141047T-2, obtainable from Office of Technical Services, U.S. Dept., of Commerce, Washington, D.C., U.S.A.

The strioscopic image (effectively the Fresnel diffraction pattern) is calculated for a plane parallel plate 1 mm thick in which the refractive index changes linearly over a 1 cm length and is constant elsewhere. The minimum detectable increment in refractive index is found to be about 4×10^{-5} on the assumption that the minimum detectable fringe visibility is 0.025. W.T.Welford

535.327

11989. DETERMINATION OF THE REFRACTION OF AIR LAYERS NEAR THE GROUND. R.Hase.
Optik, Vol. 14, No. 10, 437-45 (Oct., 1957). In German.

The use of high-precision levelling instruments is restricted due to the variations of the refractive properties, with time and locality, of the air near the ground. Therefore, the desirability is stressed of measuring atmospheric temperature gradients when making accurate surveys. The difficulties involved in such measurements are discussed and a simple, fairly robust, thermoelectric gradient meter is described.

535.33 : 518.5

11990. APPLICATION OF A DIGITAL COMPUTER TO THE ZEEMAN METHOD IN ATOMIC SPECTROSCOPY. K.L.Vander Sluis.
J. Opt. Soc. Amer., Vol. 49, No. 10, 944-7 (Oct., 1959).

The existence of high speed computers with their large capacity memories makes feasible the concept of generating complete sets of derived data in the problem of spectrum classification. This possibility leads to a closer examination of the relative merits of the three types of generating operations as judged according to the probability of generating real data and according to the generated statistical noise level. Examination shows that the treatment of the observed data in terms of the concept of Zeeman tags is by far the most fruitful approach to be taken. A quantitative evaluation of the derived data is also given. A specific set of computer routines designed to do both the computational and bookkeeping operations of the Zeeman method on the Oracle is described.

535.33 : 530.145

CALCULATION OF THE SPECTRA OF ELECTROMAGNETIC RADIATION ABSORBED OR EMITTED BY QUANTUM MECHANICAL SYSTEMS. See Abstr. 11805

535.33.03

11991. A VERY-HIGH-FREQUENCY SOURCE FOR EXCITATION OF SPECTRA IN GASEOUS MIXTURES. A.A.Vashman, L.V.Lipis and N.A.Teterina.
Optika i Spektrosk., Vol. 6, No. 2, 260-2 (Feb., 1959). In Russian

A magnetron circuit of 3000 Mc/s frequency, for excitation of spectra of gaseous mixtures, is described. The magnetron works continuously in a magnetic field of 1200 G. The gas is contained in a quartz discharge tube which is placed at an antinode in a waveguide fed from the magnetron. The apparatus was used to excite argon–helium mixtures at pressures from 0.3 to 20 torr (1 torr ≅ 1 mm Hg). It was found that the emission intensities were higher than those produced by means of 6 Mc/s sources. A.Tybulewicz

535.33.07

11992. THE EFFECTIVE WIDTH OF A LINE AS A MEASURE OF THE PHOTOGRAPHIC EFFECT. R.Intonti and A.Lais.
Ann. Phys. (Leipzig), Folge 7, Vol. 4, No. 1-5, 78-83 (1959). In German.

The intensity of a photographed spectrum line may be specified by determining the slit width of the microphotometer required to give a fixed galvanometer deflection. Tests show that the method is more sensitive than the usual one at high densities of blackening. A suitable microphotometer is described in outline. G.F.Lothian

535.33.07 : 535.421

11993. THEORY OF THE CONCAVE GRATING. III. SEYA–NAMIOKA MONOCHROMATOR. T.Namioka.
J. Opt. Soc. Amer., Vol. 49, No. 10, 951-61 (Oct., 1959).

For Pt I and II, see Abstr. 6792-3 (1959). As an example of a mounting in which the optical components are not on the Rowland cylinder, the Seya–Namioka mounting is treated mainly from the standpoint of physical optics. An ambiguity in the physical meaning of Beutler's focal conditions is clarified; using the corrected condition a brief summary of the optical conditions in this mounting is given. Astigmatism, spectral line shape, instrumental resolving power, and optimum grating width are discussed in detail and, for convenience of practical application, numerical results are also given for the following conditions: 1 m concave grating with 15 000 lines/in, first order spectrum, with ratios of the radius of curvature of the grating to the distances between the grating centre and the entrance and exit slits 1.2223, and 1.2230 respectively, and the angle between the lines connecting the grating centre to the entrance and exit slit 70°15'.

535.33.07

11994. DESIGN OF HIGH-RESOLUTION MONOCHROMATOR FOR THE VACUUM ULTRAVIOLET. AN APPLICATION OF OFF-PLANE EAGLE MOUNTING. T.Namioka.
J. Opt. Soc. Amer., Vol. 49, No. 10, 961-5 (Oct., 1959).

The possibility of constructing a high-resolution monochromator for the vacuum ultraviolet is discussed; off-plane Eagle mounting is chosen as the most suitable one. Considering all optical restrictions arising from an off-plane setting, the resolving power of the grating in the off-plane Eagle mounting is calculated numerically for the following conditions: 3 m concave grating (5 × 3 in. ruled area) with 30 000 lines/in. or 15 000 lines/in., 0 to 5800 A in the first order, and distance of the entrance slit from the Rowland plane 6 cm. In order to have conpactness, a link mechanism introduced by Bair et al. is chosen in the scanning system and a tentative design of a 3 m vacuum momochromator is shown schematically. As the result, it is recommended to use the off-plane Eagle mounting in constructing a high-resolution monochromator for the vacuum ultraviolet.

535.33.0

11995. EBERT SPECTROMETER FOR THE FAR INFRARED. D.W.Robinson.
J. Opt. Soc. Amer., Vol. 49, No. 10, 966-71 (Oct., 1959).

An Ebert spectrometer is described with regard to its design.

nstruction, and performance. It is intended to cover the 500-20 cm^{-1} gion, and has so far been tested between 500 and 150 cm^{-1}, where esolution of 0.5 cm^{-1} is uniformly attained. The advantages of Ebert optics in the long wavelength infrared are that they lead to compact, simple, and convenient instrument for this difficult re- on of the spectrum, the performance of which is at least equal to t of the more elaborate instruments.

535.33.07

996. SIMPLE SELF-RECORDING INTENSITOMETER ATTACH- ENT FOR MICROPHOTOMETERS. J.G.Phillips.
Opt. Soc. Amer., Vol. 49, No. 10, 972-3 (Oct., 1959).

A simple attachment has been added to a density-recording icrophotometer to produce automatically the intensity v. wave- ngth curve of spectra. It can be applied to any microphotometer ssessing a strip-chart density recorder.

535.33.07

997. SPECTRUM INCLINATION AND LINEAR DISPERSION OF PECTROGRAPHS. K.D.Mielenz.
ptik, Vol. 16, No. 8, 500-7 (Aug., 1959). In German.

The inclination is computed for various types of grating and ism spectrographs. It is shown that plane grating spectrographs, contrast to prism instruments, must necessarily be of achromatic sign and must, therefore, dispense with the possibility of increas- g linear dispersion by tilting the spectrum.

535.33.07 : 535.315

THE THEORETICAL RESOLUTION LIMIT OF PRISMS.
e Abstr. 11984

535.331

998. MUTUAL INFLUENCE OF SPECTRAL LINES.
.Baistrocchi and R.Sillitti.
tti Fond. Ronchi, Vol. 14, No. 1, 76-86 (Jan. Feb., 1959). Italian.

Arc spectrograms are given of Ag containing small amounts Cu. They show effects varying from normal emission in the Cu 273 A line to its reversal when overlapped by the Ag 3280 A line high current densities. The relative line intensity in the Cu ublet is known for normal conditions, hence the disturbance due the Ag line can be determined. The effect is attributed to ptical absorption in the arc. Calculations based on the assumption equal concentrations of Ag and Cu in all parts of the arc agree ith the experimental finding that the 3273 A line is completely sorbed at about 2% Cu in Ag. S.T.Henderson

535.331

1999. OSCILLATOR STRENGTHS FROM ARC SPECTRA OF ILUTED COPPER ALLOYS. C.W.Allen and A.S.Asaad.
onthly Not. Roy. Astron. Soc., Vol. 117, No. 1, 36-49 (1957).

The method of determining absolute oscillator strengths from c spectra of diluted copper alloys has been described. The scale as been averaged from various absolute measurements and calcu- tions that are available. Absolute values are tabulated for certain nes in the spectra of Al, Si, Cr, Mn, Fe, Co, Ni, Cu, Ga, Ag, Sn, Pb, d Bi. A relation between oscillator strength and excitation poten- al has been found as in earlier work, but this is now shown to be due ainly to the weakness of those transitions for which the moving lectron is equivalent in the lower level. Some empirical rules for stimating oscillator strengths in complex spectra are given.

535.331

2000. TIME SPECTRA OF SPARK-DISCHARGE EMISSION IN NERT GASES. M.P.Vanyukov, A.A.Mak and V.R.Muratov.
ptika i Spektrosk., Vol. 6, No. 1, 17-23 (Jan., 1959). In Russian.

Time spectra of the intensity of emission by spherical pulse- ischarge lamps filled with argon, xenon and krypton at 3.5 atm ere studied in the 2500-5500 A region. The apparatus had a esolving power of about 5×10^{-8} sec. It was found that in the rocess of a spark discharge a continuous spectrum and lines of ubly ionized atoms appear first. Later intensity of the doubly nized lines decreases and instead lines due to singly ionized atoms ppear in the spectrum. The latter lines decay more slowly than he continuous background. The spectral distribution of the con- nuous background differs greatly from that expected of a black ody and was found to be only weakly dependent on the wavelength. his effect may be due to non-uniformity of the temperature distrib- tion in various parts of the discharge channel and possibly also due differences in the absorption coefficient of the discharge plasma various spectral regions. A.Tybulewicz

535.331

12001. 45 RELATIVE f VALUES FOR HIGH EXCITATION IRON LINES FROM THE D.C. ARC SPECTRUM. R.Hefferlin.
J. Opt. Soc. Amer., Vol. 49, No. 10, 948-9 (Oct., 1959).

On the basis of investigations of the d.c. iron arc described in a previous paper (Abstr. 7935 of 1959), spectrophotometric determinations of iron line intensities are used to calculate relative f values for 45 high-excitation lines. These values agree with values calculated from line intensities given in another paper by Crosswhite.

535.331

12002. THE ABSOLUTE f-VALUES OF λ 3247 OF CuI AND λ 3720 OF FeI. G.D.Bell, M.H.Davis, R.B.King and P.M.Routly.
Astrophys. J., Vol. 127, No. 3, 775-96 (May, 1958).

The absolute f-values, or oscillator strengths, of the resonance lines in the CuI and FeI spectra have been measured by observing the equivalent widths of these lines absorbed by a beam of atoms whose density was directly determined. The theory of the curve of growth for a line absorbed by the atomic beam is developed, and experimental checks of the validity of the assumptions involved and of the critical features of the experiment are described. The absolute f-value of the CuI line 3247 A was found to be f = 0.31 and that of the FeI line 3720 A was f = 0.032. These results are compared with those of other investigations.

535.331

12003. ABSOLUTE OSCILLATOR STRENGTH MEASUREMENTS IN Mg, Ca AND OTHER ATOMS. C.W.Allen.
Monthly Not. Roy. Astron. Soc., Vol. 117, No. 6, 622-8 (1957).

The diluted copper alloy method of determining absolute oscillator strengths has been extended to Li, Na, K, Mg and Ca. Results could be obtained for Mg and Ca only. The original absolute intensity scale was confirmed. The results show fair agreement between observations and calculations but some disagreements have been noted. A re-examination of earlier measurements show that the oscillator strengths of the heavy atoms Ga, Ag, Sn, Pb, and Bi are systematically greater than calculated values.

535.331

12004. ISOTOPIC SHIFTS IN THE SPECTRUM OF THORIUM Th^{232}-Th^{229}. E.A.Vernȳi and V.N.Egorov.
Optika i Spektrosk., Vol. 6, No. 2, 262-3 (Feb., 1959). In Russian.

Isotopic shifts in the emission spectrum of thorium were measured in a sample containing Th^{229} and Th^{232} in the ratio 1 : 1. The thorium spectrum was excited in an alternating current arc at 5 A in an atmosphere of carbon dioxide (to suppress cyanogen bands). A 2 m spectrograph with a Paschen-mounted diffraction grating was used to find the isotopic shifts in over 250 lines in the region 2600-4400 A. The results are given in the form of the ratio of the shifts $\Delta(232\text{-}229)/\Delta(232\text{-}230)$. For the majority of the lines this ratio lay between 1.6 and 1.8, in agreement with the general theory of even–uneven effects in heavy nuclei. A.Tybulewicz

535.332 : 531.711

12005. DISCUSSION OF THE REPRODUCIBILITY OF THE WAVE-LENGTH OF THE $2p_{10}$-$5d_5$ EMISSION LINE OF Kr^{86}, THE PROPOSED STANDARD UNIT OF LENGTH. J.Terrien.
C.R. Acad. Sci. (Paris), Vol. 248, No. 15, 2171-2 (April 13, 1959). In French.

The variation of the wavelength of this line with current density and pressure has been investigated. From the results obtained the non-perturbed wavelength can be found by extrapolating the results to zero current density and pressure. It is estimated that the determination of the wavelength can be reproduced to an accuracy better than 2×10^{-9}. R.D.Hudson

535.333

12006. NEW EMISSION SPECTRUM OF CHLORINE IN THE SCHUMANN REGION. P.B.V.Haranath and P.Tiruvenganna Rao.
Indian J. Phys., Vol. 31, No. 3, 175-6 (March, 1957).

Two extensive band systems have been discovered, in the region λ1400-λ1820. P.Young

535.333

12007. SPECTRUM AND STRUCTURE OF THE FREE METHYLENE RADICAL. G.Herzberg and J.Shoosmith.
Nature (London), Vol. 183, 1801-2 (June 27, 1959).

A group of lines at 1415 A occurring in the flash photolysis of diazomethane has been identified as being due to CH_2. Reasons for the identification are discussed and the molecular constants calculated. P.Young

535.333

12008. A NEW TRANSITION IN MOLECULAR NITROGEN. P.K.Carroll.
Canad. J. Phys., Vol. 36, No. 11, 1585-7 (Nov., 1958).

Wave-numbers of P and R branch lines up to N = 37 of a new band at 1589.745 A excited in a hollow-cathode discharge through pure N_2 at low pressures were measured. Band analysis shows that $B' = 1.8644\ cm^{-1}$, $B'' = 1.8801\ cm^{-1}$, $D' = 7.1 \times 10^{-6}\ cm^{-1}$, $D'' = 6.9 \times 10^{-6}\ cm^{-1}$. While positive identification of the emitter must await excitation of other bands arguments in favour of N_2, N_2^+, N_2^{2+} are advanced. R.W.Nicholls

535.333

12009. VIBRATIONAL RELAXATION OF CN IN THE SHOCK TUBE. W.Roth.
J. chem. Phys., Vol. 31, No. 3, 720-1 (Sept., 1959).

The violet system of CN is observed in emission behind shock waves in impure Xe. Electronic transitions originating from high vibrational levels are observed earlier than those originating from lower levels. The time lapse between (1,1) and (0,0) transitions is attributed to the $v' = 1 \rightarrow v' = 0$ vibrational transition and this is shown to be in agreement with Bethe–Teller theory.

535.333

12010. NEW EMISSION SPECTRUM OF THE TeO MOLECULE. P.B.V.Haranath, P.Tiruvenganna Rao and V.Sivaramamurty.
Z. Phys., Vol. 155, No. 5, 507-17 (1959).

The spectrum of TeO, excited in a heavy arc energized by a 2000 V d.c. generator, was studied in the visible and ultraviolet regions. Photographs of the spectrum revealed many new bands in the region from 6200 to 3300 A, which are clearly degraded to longer wavelengths. Some of the bands in the region from 3800 to 3300 A were identified with those of the system in the region from 3800 to 3060 A (here designated as B–X) observed and analysed by Choong Shin Piaw. The analysis of the B–X system was extended to include some of the new bands up to 4500 A. In addition to those assigned to B–X system, a number of new bands in the region from 5000 to 3500 A constitute another system designated A–X. The analysis of this system has led to the following quantum formula for the band heads:

$$\nu = 27\,835 + 408(v' + \tfrac{1}{2}) - 4.0(v' + \tfrac{1}{2})^2 - 796(v'' + \tfrac{1}{2}) + 3.5(v'' + \tfrac{1}{2})^2.$$

The lower state of the two systems is common and is identified as the ground state of the TeO molecule. Bands in the region from 6200 to 5000 A were analysed as belonging to another brief system. This system appears to arise from a transition between two excited states of the TeO molecule. The nature and properties of electronic terms responsible for the observed electronic states of the TeO molecule are discussed along with those of the related molecules O_2, SO, and SeO from considerations of electron configurations.

535.333

12011. EMISSION SPECTRA OF MIXED HALOGENS. I. ICl. P.B.V.Haranath and P.Tiruvenganna Rao.
Indian J. Phys., Vol. 31, No. 3, 156-71 (March, 1957).

The emission spectrum of ICl, excited in a condensed discharge from a 20 kV transformer and in a high-frequency discharge from a 100 W oscillator was photographed from the visible down to the vacuum ultraviolet. The spectrum excited in the condensed discharge revealed a new system of discrete bands, about 300 in number, in the region from 4400 to 3800 A. Vibrational analysis of these bands has led to the following quantum formula

$$\nu = 23997.0 + 173.2(v' + 1/2) - 1.1\ v' + 1/2)^2 - 209.7(v'' + 1/2) + 1.9(v'' + 1/2)$$

From the equality of the vibrational constants, the lower state of this system is identified as the $^3\Pi_1$ state of the near infrared absorption bands of ICl. A study of the chlorine isotope effect for some of the bands on the short wavelength end of the spectrum is also made. Spectra photographed in the vacuum ultraviolet region revealed two systems in the region 1910 to 1670 A known earlier in absorption. Vibrational analyses of these systems are extended to include some more new bands obtained in emission.

535.333

12012. EMISSION SPECTRA OF MIXED HALOGENS. II. IBr AND BrCl. P.B.V.Haranath and P.Tiruvenganna Rao.
Indian J. Phys., Vol. 31, No. 7, 368-75 (July, 1957).

The emission spectra of IBr and BrCl, excited by the same sources used for ICl, are photographed from the visible down to the vacuum ultraviolet. In the visible, unlike ICl, the spectrum of IBr revealed only a brief system of about 40 bands, in the region from 3900 to 3800 A. The analysis of these bands has led to the following vibrational constants: $\omega_e' = 104.0\ cm^{-1}$; $x_e'\ \omega_e' = 0.8\ cm^{-1}$, $\omega_e'' = 140.0\ cm^{-1}$; $x_e''\ \omega_e'' = 1.9\ cm^{-1}$; $\nu_e = 26076\ cm^{-1}$. The lower state of this system is identified as the $^3\Pi_1$ state of the infrared absorption bands of IBr. The spectrum of BrCl has revealed only six continuous diffuse bands in the region 3600 to 2500 A. In the vacuum ultraviolet, the two systems, known earlier in absorption for each of these molecules, are recorded. In the case of IBr, some more bands have been newly obtained in emission and are assigned to the two systems. The nature and properties of the new electronic states identified in ICl and IBr are discussed in relation to the term scheme of these molecules.

535.333

12013. MILLIMETER WAVE SPECTRUM AND STRUCTURE OF FORMYL FLUORIDE. P.Favero, A.M.Mirri and J.G.Baker.
J. chem. Phys., Vol. 31, No. 2, 566-7 (Aug., 1959).

The rotational spectrum of formyl fluoride was studied in the frequency range 90-160 kMc/s. The spectrum observed indicates a planar molecule having parameters in good agreement with those obtained by electron diffraction. [Jones, Hedberg and Schomaker, J. Amer. Chem. Soc., Vol. 77, No. 20, 5278 (Oct. 20, 1955)]. S.A.Ahern

535.33

12014. THE FOWLER LINE 3203 OF IONIZED HELIUM IN UNIFORM ELECTRIC FIELDS. W.Steubing and J.Hengevoss.
Ann. Phys. (Leipzig), Folge 7, Vol. 2, No. 3-4, 191-207 (1958). In German.

A very detailed analysis and discussion of experimental data on Stark effects for this line. J.D.Cragg

535.337 : 537.311.3

12015. ZEEMAN EFFECT ON THE INTRINSIC RECOMBINATION EMISSION IN GERMANIUM. C.Benoit à la Guillaume and O.Parodi.
J. Electronics and Control, Vol. 6, No. 4, 356-8 (April, 1959). In French.

The shift of intrinsic recombination from germanium has been observed in high magnetic fields. This shift is about 4×10^{-4} eV in a field of 40 000 Oe, which shows this radiation is due to exciton annihilation. The energy of the LA phonon is found to be $(27.2 \pm 0.1) \times 10^{-3}$ eV and the energy gap $(744.3 \pm 0.2) \times 10^{-3}$ eV.

535.337 : 537.311.3

12016. QUANTUM MAGNETO-ABSORPTION PHENOMENA IN SEMICONDUCTORS. B.Lax, L.M.Roth and S.Zwerdling.
J. Phys. Chem. Solids, Vol. 8, 311-18, 336-7 (Jan., 1959).

Rochester Semiconductors Conference Paper (see Abstr. 4569 of 1959). The existence of quantized magnetic or Landau levels in semiconductor in a magnetic field can give rise to a variety of magneto-absorption phenomena. The oscillatory magneto-absorption of the direct transition has been observed in germanium, indium arsenide and indium antimonide. The fine structure of the low temperature data in germanium has been correlated with the theory, taking into account the complex band structure. The indirect magneto-absorption spectrum in germanium has also been observed and in accordance with theory, it appears as a sequence of steps which is modified by a finite line width. A third type of magneto-absorption associated with transitions between the degenerate and split-off bands as in germanium and gallium arsenide is shown to have both oscillatory and non-oscillatory components. The Zeeman effect of impurities and excitons which is closely related to the above phenomena can give information about the band structure of semiconductors. For ellipsoidal energy surfaces, the linear effect evaluates the transverse mass and the anisotropy of the quadratic Zeeman effect for electrons is exactly analogous to the results of cyclotron resonance. Quantum effects can occur in the Faraday rotation and free carrier absorption in a magnetic field.

535.337 : 537.311.

12017. THEORY OF FINE STRUCTURE ON THE ABSORPTION EDGE IN SEMICONDUCTORS. R.J.Elliott and R.Loudon.
J. Phys. Chem. Solids, Vol. 8, 382-8, 421-2 (Jan., 1959).

Rochester Semiconductors Conference Paper (see Abstr. 4569 of 1959). General equations are derived for the details of the dire

a orption edge in a semiconductor when the effects of excitons and o n applied external magnetic field are included. The effects p duced by magnetic fields and excitons separately are readily d ived as special cases and these are briefly reviewed with refer- e e to work already published. The problem including both simul- t eously could not be solved in general, but expressions for the c tinuous absorption are obtained in an approximation valid in large n gnetic fields. Simple spherical bands are assumed throughout a l spin effects neglected.

535.337

1 18. THE INFLUENCE OF COMPRESSED GASES ON THE V POUR DENSITY OF MERCURY AND ON THE OSCILLATOR S RENGTH OF THE 2537 A LINE.
J .Strijland and A.J.Nanassy.
P sica, Vol. 24, No. 11, 935-6 (Nov., 1958).

The total absorption of the mercury resonance line, for mixtures o compressed gases (up to 2000 atm.) saturated with mercury v our, increases with increasing pressure when the foreign gas i argon or nitrogen, but decreases when it is hydrogen or helium. R sults for unsaturated mixtures, obtained by isothermal expansion f m the saturated systems, show that this is due to like changes i he mercury vapour-pressure, which increases in the presence o N or A but decreases in the presence of H or He; whilst the o illator strength of the line remains constant. P.Young

535.338

1 19. OBSERVATIONS ON THE ELECTRON—ATOM COLLISION CNTINUUM IN ELECTRODE-STABILIZED HIGH PRESSURE M RCURY ARCS. W.Neumann and H.Reimann.
A . Phys. (Leipzig), Folge 7, Vol. 3, No. 3-4, 211-19 (1959). In German.

Briefly discusses several causes of continua in the emission s ctra of arcs, in particular free—free transitions in the field of: (a positive ions, and (b) neutral atoms. Special attention is given to (Data on Hg arcs are given and discussed. J.D.Craggs

535.338

1020. ON THE DISTRIBUTION OF INTENSITY ALONG A C NTOUR OF A SELF-REVERSIBLE SPECTRAL LINE.
N .Preobrazhenskii.
Ctika i Spektrosk., Vol. 6, No. 1, 120-21 (Jan., 1959). In Russian.

The theory of a non-uniform source of light developed by Cowan a d Dieke (Abstr. 3232 of 1948) gives the distribution of intensity a ng a reversible spectral line contour. The present author derives a impler approximate formula which gives the same intensity d tribution, but is valid only for $1 < n < 2$, which is the range of i net in arc discharges (n is the degree of non-uniformity of the s urce). A.Tybulewicz

535.338 : 537.56

1021. STRUCTURE OF SPECTRAL LINES FROM PLASMAS.
J Margenau and M.Lewis.
R v. mod. Phys., Vol. 31, No. 3, 569-615 (July, 1959).

Careful review of the theoretical methods that have been used t study the broadening of spectral lines of optical frequencies e itted in strongly ionized media. The relation between the two m in types of theory, the statistical and impact theories, is pointed o t, and their respective regions of applicability indicated, by d scussing a more general approach of which they are special cases. V rious refinements and particular applications of the theories are p esented, and the results discussed, as are some relevant experi- m ntal results and their interpretation. Over 100 references. J.Hawgood

535.338.3

1022. INTERFEROMETRIC INVESTIGATIONS OF LINE PRO- LES IN A FREELY BURNING ELECTRIC ARC. K.Bergstedt.
Phys., Vol. 155, No. 1, 23-41 (1959). In German.

Interferometric studies are made on line profiles using a Fabry— rot interferometer. The sources are a variety of elements in the w current carbon arc. Data are given for iron and lanthanum e ctra. The computations are made of the effect of apparatus w dth permitting the true Doppler effect to be derived. The influence o hyperfine structures on the total intensity of line is shown experi- m ntally for the case of LaII. S.Tolansky

535.338.333

1023. STUDIES OF ISOTOPIC DISPLACEMENT IN ATOMIC S ECTRA OF HEAVY ELEMENTS. J.Blaise.
A n. Phys. (Paris), Ser. 13, Vol. 3, No. 11-12, 1019-76 (Nov.-Dec., 1958). In French.

Line spectra of Cd, Nd, Os, Hg and Pb were investigated with a Fabry—Perot spectrometer of effective resolving power 10^6. It is shown that for all lines from one element, the relative positions of those from different isotopes are identical, and that all terms of the same electronic configuration show the same isotopic displacements in the absence of perturbations by terms of other configurations. The effect of such perturbations is considered in detail for Pb and Hg. Spectra of Pb I, Os I and Nd I were elucidated. Effects of deformation of nuclei on isotopic displacements are discussed, leading to a classification of the neutron shells between the magic numbers 82 and 126, and the "odd—even staggering" is interpreted on the shell model. The spin $\frac{3}{2}$ for Os^{189} is confirmed, contrary to the shell model, but compatible with Nillson's model of strongly deformed nuclei.
A.E.I. Research Laboratory

535.338.334

12024. INVESTIGATION OF THE RADIATION FLUX DIVERGENCE OF THE 2537 A LINE IN A MERCURY DISCHARGE.
V.P.Titushina and V.A.Fabrikant.
Optika i Spektrosk., Vol. 5, No. 1, 3-9 (1958). In Russian. English summary: PB 141047T-6, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The divergence of radiation and the electron temperature and density were measured in mercury discharges with particular reference to the 2537 A line to measure the effect of radiative and de-excitation collision effects. It is concluded that the excitation of the 6^3P_1 level is complex and determined by diffusion of radiation and electron density. R.W.Nicholls

535.34 : 539.19

12025. THE SHAPE OF THE ABSORPTION AND EMISSION BANDS OF COMPLEX MOLECULES. N.G.Bakhshiev.
Optika i Spektrosk., Vol. 6, No. 2, 250-2 (Feb., 1959). In Russian.

Unidimensional models of potential curves constructed for electron-vibrational spectra make it possible to obtain formulae which give the distribution of intensities in the absorption and fluorescence spectra in good agreement with experiment. The author suggests that the large anharmonicity of the potential functions of complex molecules should be taken into account in calculations of absorption bands. This suggestion is confirmed by the good agreement obtained between the calculated and experimentallydetermined absorption spectra of phthalimide derivatives. The author concludes that the contours of the continuous absorption and emission bands of complex molecules are determined by three factors: (a) distribution of the vibrational energy; (b) the form of the potential curves; and (c) anharmonicity of the latter. A.Tybulewicz

535.34 : 539.19

12026. A THEORY OF THE HYPERFINE STRUCTURE OF ROTATIONAL SPECTRA OF SYMMETRICAL-TOP MOLECULES.
K.K.Svidzinskii.
Optika i Spektrosk., Vol. 6, No. 2, 254-6 (Feb., 1959). In Russian.

The hyperfine structure of symmetrical-top molecules was calculated. The energy of interaction of nuclei with electrical and magnetic fields of a molecule was represented by means of a scalar product of irreducible tensor operators. The calculations allowed for electric multipole, magnetic multipole, magnetic dipole, spin—spin and spin—orbit interactions. A.Tybulewicz

535.34.07

12027. HIGH-DISPERSION INFRARED SPECTROSCOPY.
Y.Cornet, C.Haeusler and P.Barchewitz.
C.R. Acad. Sci. (Paris), Vol. 248, No. 23, 3290-1 (June 8, 1959). In French.

Description of a grating spectrometer of the Czerny type using a grating ruled at 600 lines/mm, suitable for use in the range 1.2-3 μ. Performance is illustrated by the vibration—rotation spectrum obtained for CH_3I around 6050 cm^{-1}. R.C.Seymour

535.34.07

12028. A MICRO-SPECTROPHOTOMETER FOR VISIBLE LIGHT. J.R.Cordero Funes and A.Oscar Pogo.
Cienc. e Invest., Vol. 14, No. 12, 516-26 (Dec., 1958). In Spanish.

A description is given of a microspectrometer used for investigating absorptions of cellular material. The paper contains a detailed account of the illuminating system, monochromator, microscope and photomultiplier unit. R.W.Fish

535.34.07

12029. LONG CELL FOR SPECTROGRAPHIC STUDIES UNDER HIGH PRESSURES. R.Coulon, J.Robin and B.Vodar.
J. Phys. Radium, Vol. 20, No. 5, 570-2 (May, 1959). In French.

The construction and operation of apparatus for the study of the absorption spectra of gases is described. G.I.W.Llewelyn

535.343

12030. EFFECTS OF PRESSURE ON THE ABSORPTION BAND OF THE BENZENE–IODINE COMPLEX AND ON THE ABSORPTION SPECTRUM OF BENZENE IN THE COMPLEX STATE.
B.Oksengorn.
J. Phys. Radium, Vol. 20, No. 5, 572-3 (May, 1959). In French.

Results are presented in graphical form and briefly discussed. G.I.W.Llewelyn

535.343

12031. SOME SELECTION RULES FOR BAND–BAND TRANSITIONS IN WURTZITE STRUCTURE. J.L.Birman.
Phys. Rev., Vol. 114, No. 6, 1490-2 (June 15, 1959).

Optical selection rules at k = (0, 0, 0) in the wurtzite structure are discussed. These rules suggest an interpretation of recently reported work on CdS by Dutton and Lempicki on reflection spectra, and the excitation spectrum of edge emission in polarized light. Assuming band–band transitions at k = (0, 0, 0) are involved, a valence band spin–orbit splitting of 0.0167 eV and crystal field splitting of about 0.070 eV (at liquid N_2 temperature) are obtained for CdS. Other predictions of the model and other possible interpretations of the data are discussed.

535.343

12032. OPTICAL PROPERTIES OF NICKEL OXIDE.
R.Newman and R.M.Chrenko.
Phys. Rev., Vol. 114, No. 6, 1507-13 (June 15, 1959).

The absorption spectrum of single crystal NiO has been measured in the 0.1 to 6 eV range and its reflectivity spectrum from 0.025 to 10 eV. The absorption spectrum shows a series of lines from 1 to 3.5 eV arising from internal transitions of the Ni ion. A continuous background absorption occurs in the range from 0.1 to 3.5 eV whose magnitude increases with impurity concentration. The absorption coefficient rises steeply above 3.5 eV and reaches a value of 10^6 cm^{-1} at and above 4 eV. An absorption line at 0.24 eV is found to be temperature sensitive in both intensity and frequency in the range above 300°K. Its behaviour suggests that it is connected with the antiferromagnetic ordering. The reststrahlen spectrum was observed with the following parameters: high- and low-frequency dielectric constants 5.4 and 12, respectively; energies of longitudinal and transverse optical mode vibrations are 0.076 and 0.044 eV, respectively.

535.343

12033. OSCILLATOR STRENGTHS IN THE FAR ULTRAVIOLET. I. NITRIC OXIDE. G.W.Bethke.
J. chem. Phys., Vol. 31, No. 3, 662-8 (Sept., 1959).

Absolute integrated absorption intensities were measured for the nitric oxide beta, gamma, delta, and epsilon bands in the range 1700 to 2300 A. From these data the electronic absorption oscillator strengths of the beta and gamma band systems were calculated to be 0.00151 ± 7% and 0.00240 ± 5%, respectively. The experimental method involved the photometric detection of pressure-broadened nitric oxide spectra. Also described is the construction of a logarithmic load resistance which allows the direct tracing of spectra in absorbance units.

535.343

12034. OSCILLATOR STRENGTHS IN THE FAR ULTRAVIOLET. II. OXYGEN SCHUMANN–RUNGE BANDS. G.W.Bethke.
J. chem. Phys., Vol. 31, No. 3, 669-73 (Sept., 1959).

Absolute integrated absorption intensities were measured for the oxygen Schumann–Runge band system. From these data the total band system absorption oscillator strength was found to be between 0.00027 and 0.00031 while from the band strengths the electronic absorption oscillator strength was calculated to be 0.163 ± 10%. The experimental method involved the photometric detection of pressure-broadened oxygen spectra from 1750 to 2000 A.

535.343

12035. FORBIDDEN BAND SYSTEMS IN NITROGEN. II. THE a' $^1\Sigma_u^- \leftarrow X\,^1\Sigma_g^+$ SYSTEM IN ABSORPTION.
P.G.Wilkinson and R.S.Mulliken.
J. chem. Phys., Vol. 31, No. 3, 674-9 (Sept., 1959).

For Pt I, see Abstr. 6720 (1959). Four bands of the a' $^1\Sigma_u^- \leftarrow X\,^1\Sigma_g^+$ system in nitrogen have been observed in absorption at high resolution in a path of 3.4 meter-atmospheres, at 1444 A (1-0), 1414 A (2-0), 1358 A (4-0), and 1331 A (5-0). They consist of Q branches only ($\Delta J = 0$). The observation of these bands, highly forbidden by the usual selection rules, is explainable by perturbation with the nearest $^1\Pi_u$ states lying between about 98 000 cm^{-1} and 109 000 cm^{-1} above the ground state. The rotational analysis of each of the bands resulted in rotational constants and vibrational intervals for a' $^1\Sigma_u^-$ which agree very well with those obtained from the emission system $x^1\Sigma_g^- \rightarrow a'\,^1\Sigma_u^-$. The electronic energy (T_{oo}) of state a' $^1\Sigma_u^-$ is now precisely located at 67 738.18 cm^{-1} (8.398 eV); this value combined with other data gives also the following electronic energies (T_{oo}): $w^1\Delta_u$, 71 697.68 cm^{-1} (8.889 eV); $x^1\Sigma_g^-$, 113 215.98 cm^{-1} (14.036 eV); and $y^1\Pi_g$, 114 165.18 cm^{-1} (14.154 eV). T_{oo} of a' $^1\Sigma_u^-$ is close to that of $a^1\Pi_g$: 68 951 cm^{-1} (8.548 eV). The new energy for $y^1\Pi_g$ is 0.339 eV lower than the minimum value deemed possible by Lofthus and Mulliken on the basis of an observed predissociation at v = 0, J = 10 of state y. That predissociation is now reinterpreted as most probably an accidental one resulting in the formation of $^2P + {}^4S$ atoms instead of $^2D + {}^2D$ atoms as formerly assumed. The intensity distribution in the a' $^1\Sigma_u^- \leftarrow X\,^1\Sigma_g^+$ system is found to be approximately proportional to $J(J + 1)(2J + 1) \exp[-B_0''(J + 1)hc/kT]$, where $B_0'' = 1.9898$ cm^{-1} and T = 300°K, in agreement with theory. From appearance pressures of the five forbidden systems of nitrogen now known in absorption, it is possible to estimate the transition probabilities. From these, together with a recent molecular beam determination of the mean lifetime of the state $a^1\Pi_g$, it is possible to estimate the lifetimes of the metastable states $A^3\Sigma_u^+$, 2.6×10^{-2} sec, a' $^1\Sigma_u^-$, 4.0×10^{-12} sec. By comparison of the transition probability of the atmospheric oxygen bands ($b^1\Sigma_g^+ \leftarrow X^3\Sigma_u^-$) with that of the Vegard–Kaplan bands of nitrogen ($A^3\Sigma_u^+ \leftarrow X\,^1\Sigma_g^+$), together with the known lifetime of $b^1\Sigma_g^+$, the value 6.5×10^{-3} sec is found for the lifetime of $A^3\Sigma_u^+$, in fair agreement with the value given above.

535.34

12036. ABSORPTION AND EMISSION SPECTRA OF SINGLY- AND MULTIPLY-ACTIVATED KBr PHOSPHORS.
H.Leutz and H.Muuss.
Z. Phys., Vol. 155, No. 5, 531-46 (1959). In German.

Pb^{++}-, Tl^+-, Ag^+- and Cu^+-activated potassium bromide crystals were studied at room temperature. The absorption spectra of KBr crystals activated with combinations of these ions are additive combinations of the absorption bands of the singly-activated crystals. The emission spectrum of KBr(Tl) is changed by the addition of the other activators. This fact demonstrates that the absorption and emission of light in KBr(Tl) phosphors is caused by transitions between states of the KBr lattice and states of the Tl^+ activator. A corresponding model for these transitions in KBr(Tl) is suggested.

535.34

12037. ULTRAVIOLET ABSORPTION SPECTRA OF ORTHO- AND PARA-CHLOROANISOLE IN THE LIQUID AND SOLID STATES.
S.B.Banerjee.
Indian J. Phys., Vol. 31, No. 3, 135-40 (March, 1957).

The results are discussed and compared with those for the substances in the vapour state and for other analogous compounds in different states as reported previously by other workers. For each compound, the ν_o-band is found to undergo a large shift towards longer wavelengths when the vapour is liquefied. In the case of o-chloroanisole, the spectrum due to the liquid appears to consist of two series of bands separated by about 23 A from each other, while the spectrum of the solid shows only one series of narrower bands. The results have been interpreted on the assumption that in the liquid state there are probably two types of molecules corresponding to the cis- and trans-positions of the methoxy group in the molecule with respect to the chlorine atom.

535.3

12038. MEASUREMENT OF ABSOLUTE VALUES OF THE OSCILLATOR STRENGTHS OF SPECTRAL LINES OF Ga I AND In I.
Yu.I.Ostrovskii and N.P.Penkin.
Optika i Spectrosk., Vol. 4, No. 6, 719-24 (June, 1958). In Russian. English summary: PB 141047T-11, obtainable from Office of Technical Services, U.S.Dept. of Commerce, Washington, D.C., U.S.A.

Uses the "hooks" method (Hacken-methode) of Rozhdestvenskii [Ann. Phys. (Leipzig), Vol. 39, 307 (1912)], together with vapour pressure data, to determine the f-values of Ga I and In I absorption lines. The lines studied were: Ga I 4172, 4032, ($^2P^o - {}^2S$), 2944,

2 3, 2874, ($^2P^0$–^2D); In I 4511, 4102, ($^2P^0$–^2S), 3039, 3259, 3256, ($^2P^0$–^2D). Tables of f-values are given. P.A.Young

535.343

1 39. VIBRATIONAL INTENSITY DISTRIBUTIONS IN THE NITROGEN AFTERGLOW. U.H.Kurzweg and H.P.Broida. J nolecular Spectrosc., Vol. 3, No. 4, 388-404 (Aug., 1959).

Nitrogen afterglows produced in a fast-flow system by an e ctrodeless discharge have been studied as a function of pressure, flv, diluent, and temperature. Intensity measurements of the N_2 1 positive bands ($B^3\Pi - A^3\Sigma$) responsible for the visible afterglow w e obtained by means of a photoelectric recording monochroma r. It is shown that the vibrational intensity distributions are not e lainable by the generally accepted, pre-association model of the a rglow phenomena. High resolution scans depicting the relative i nsity behaviour of the $B^3\Pi - A^3\Sigma$ system under a variety of con- d ons are presented.

535.343

1 40. PRODUCTION OF THE ABSORPTION SPECTRUM OF AlO E ELECTRICAL EXPLOSION OF A WIRE [Al] IN AIR AT ATMOSHERIC PRESSURE. V.A.Loginov. C ika i Spektrosk., Vol. 6, No. 1, 111-13 (Jan., 1959). In Russian.

The AlO lines (formed by oxidation) were found to be superposed on continuous radiation. The observed system of absorption ds of AlO in the 4300-5400 A region is ascribed to the $^2\Sigma^+ \rightleftharpoons X^2\Sigma^+$ t nsition, where $X^2\Sigma^+$ is the ground state of AlO. A.Tybulewicz

535.343

041. ABSORPTION SPECTRUM OF MANGANOUS FLUORIDE. W.Stout. chem. Phys., Vol. 31, No. 3, 709-19 (Sept., 1959).

The absorption spectrum of single crystal MnF_2 was measured the range 2700-6000 A. In the room temperature axial spectrum, ks are observed which are identified with transitions from the g(^6S) ground level to various quartet levels. The wave numbers units of 10^3 cm^{-1} corresponding to transitions to the various levels e: $^4T_{1g}(^4G)$, 19.44; $^4T_{2g}(^4G)$, 23.5; $^4A_{1g}(^4G)$, 25.19; $^4Eg(^4G)$, 25.50; $^4_{2g}(^4D)$, 28.12 and 28.37: $^4Eg(^4D)$, 30.23; $^4T_{1g}(^4P)$, 33.06. The spectrum is interpreted in terms of a perturbation of the free ion energy vels by an octahedral ligand field including the diminution of the gnitude of the $d\gamma$ orbitals on the Mn^{++} ion by a factor $(1 - \epsilon)^{1/2}$ in lculating the Coulomb and exchange integrals. ϵ is the "covalency rameter" of Koide and Pryce (Abstr. 4873 of 1958). Energy trices in the strong field representation and the free-ion representation are calculated. The spectra are fitted with $\epsilon = 0.064$ and e octahedral ligand field parameter $Dq = 0.78 \times 10^3$ cm^{-1}. From easurements of the π and σ spectra with polarized light it is concluded that the transitions are electric dipole ones. The spectra re also photographed with a grating spectrograph at temperatures wn to 20°K. At 20°K sharp lines are seen corresponding to the nsitions to the $^4A_{1g}(^4G)$, $^4T_{2g}(^4D)$, and $^4Eg(^4D)$ levels. A shift of out 0.06×10^3 cm^{-1} in the transition to the $^4A_{1g}$ level between 77° d 20°K is in agreement with that expected from the effect on the ergy levels of the antiferromagnetic ordering energy.

535.343

042. ABSORPTION SPECTRUM OF $NiCl_2$ IN MOLTEN LiCl/KCl. R.Sundheim and G.Harrington. chem. Phys., Vol. 31, No. 3, 700-1 (Sept., 1959).

The absorption maxima are discussed from the point of view of e ligand field theory. It is concluded that the nickel ion is surunded by four chloride ions in a nearly tetrahedral arrangement. ariations in the intensity of one of the bands gives a sensitive indicion of the degree of distortion of this structure.

535.343

043. THE ABSORPTION SPECTRA OF VANADIUM-COLOURED ORUNDUM AT LOW TEMPERATURES (DOWN TO 1.7°K). V.Grum-Grzhimailo, N.A.Brilliantov and R.K.Sviridova. ptika i Spektrosk., Vol. 6, No. 2, 238-9 (Feb., 1959). In Russian.

Absorption spectra were obtained for crystals in the form of mm thick plates cut parallel to the optical axis. The spectra nsist, especially at 1.7°K, of a series of vibrational bands, separad by approximately equal distances from one another. This structre agrees well with Krivoglaz and Pekar's theory (1953). A.Tybulewicz

535.343

12044. THE ABSORPTION SPECTRA OF RUBIES AT LOW TEMPERATURES (DOWN TO 1.7°K). S.V.Grum-Grzhimailo, N.A.Brilliantov, R.K.Sviridova and A.S.Dzhamalova. Optika i Spektrosk., Vol. 6, No. 2, 240-2 (Feb., 1959). In Russian.

Absorption spectra were obtained at the temperatures of liquid nitrogen, hydrogen and helium, both for the ordinary and extraordinary waves, using polarized light. The samples were in the form of 0.4-2.3 mm thick plates cut parallel to the optical axis. Two absorption bands which are responsible for the colour of rubies were observed: one in the visible region and the other at the boundary between the visible and ultraviolet regions. The vibrational structure observed in the spectra agrees well with Krivoglaz and Pekar's theory (1953). A.Tybulewicz

535.343

12045. VIBRATIONAL SPECTRUM OF CYANATE ION IN VARIOUS ALKALI HALIDE LATTICES. A.Maki and J.C.Decius. J. chem. Phys., Vol. 31, No. 3, 772-82 (Sept., 1959).

The infrared absorption spectra of dilute solid solutions of cyanate ion in KI, KBr, KCl, and NaCl single crystals were examined between 600 and 5000 cm^{-1} at temperatures ranging from 150° to 480°K. Over fifty distinct maxima were observed and assigned (including numerous isotopic, combination, and hot bands) in the most concentrated sample, for which KBr was the solvent. A strong Fermi resonance between $2\omega_2$ and ω_1 occurs. The vibrational energy has been expressed in terms of the eleven fundamental frequency and anharmonicity constants appropriate to a linear, unsymmetric triatomic molecule. Force constants in the KI solvent lattice are $f_{NC} = 15.51$, $f_{CO} = 11.03$, $f' = 1.35$, and $(f_\alpha/l_1 l_2) = 0.506$ mdyne/A, a result which shows very clearly that the NC bond is of higher order than the CO bond in the cyanate ion, and that the latter bond is notably weaker in cyanate ion than in CO_2, where its force constant is 16.0. In general, the fundamental frequencies increase as the lattice constant decreases. Fairly detailed calculations show that although the induction energy term arising from the dipoles induced in the solvent by the vibrating cyanate ion is not negligible, the observed variation of frequency cannot be explained by the induction term alone and must involve the short-range, repulsive forces.

535.343

12046. VIBRATIONAL SPECTRA OF SILICATES. B.I.Stepanov and A.M.Prima. Optika i Spektrosk., Vol. 4, No. 6, 734-9 (June, 1958). In Russian. English summary: PB 141047T-11, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Theoretical. Presents details and results of approximate calculations of the frequencies, intensities and polarizations of the valency vibrations of the following silicate crystals: pyroxenes, β-cristobalite, β-quartz, and an infinite layer of SiO_4 tetrahedra. The infrared and Raman spectra were also calculated. J.Hawgood

535.343

12047. INFRARED SPECTRA AT LOW TEMPERATURES AND STRUCTURE OF QUARTZ AND CRISTOBALITE. T.A.Sidorov. Optika i Spektrosk., Vol. 4, No. 6, 800-1 (June, 1958). In Russian. English summary: PB 141041T-11, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Measurements on the infrared absorption bands of quartz and cristobalite at room temperature and 77°K confirm the presence of intramolecular vibrations in the two substances and the existence of crystalline modifications. The results also make it possible to explain the temperature behaviour of low-frequency bands in the Raman spectrum of crystalline quartz. D.L.Greenaway

535.343

12048. THE INFRARED ABSORPTION SPECTRUM OF CUPROUS OXIDE. I.Pastrnyak. Optika i Spektrosk., Vol. 6, No. 1, 107-9 (Jan., 1959). In Russian.

Absorption curves were obtained of Cu_2O samples (prepared by oxidation of copper plates with subsequent annealing in an atmosphere of oxygen). For the regions of strong absorption the copper oxide layer was reduced to a fraction of a micron. Measurements were also made on samples prepared from powdered Cu_2O mixed with KBr and pressed into the form of plates. Measurements were made in the range 5-25 μ and the results are given in graphs and tables. In a short discussion some of the observed peaks are interpreted as vibrational frequencies of the crystal. A.Tybulewicz

535.343

12049. INFRARED ABSORPTION SPECTRUM OF CERTAIN MICAS. R.Ţiţeica and G.Palade.
Rev. de Physique (Bucarest), Vol. 4, No. 1, 93-7 (1959). In French.

Five varieties of mica have been studied in the visible to 25μ frequency range. Results for each mica are given in detail and separately discussed. G.I.W.Llewelyn

535.343

12050. MEASUREMENTS ON CsBr IN THE REGION OF THE INFRARED RESONANCE VIBRATION. R.Geick.
Z. Naturforsch., Vol. 14a, No. 2, 196-7 (Feb., 1959). In German.

Measurements on thin films, showing a transmission minimum at 136 μ, agree with a transmission curve calculated from dispersion data. G.F.Lothian

535.343

12051. EFFECT OF PRESSURE ON THE SPECTRA OF OLIVINE AND GARNET. A.S.Balchan and H.G.Drickamer.
J. appl. Phys., Vol. 30, No. 9, 1446-7 (Sept., 1959).

The effect of pressure has been measured on the absorption edge of olivine and on the Fe^{++} peak of garnet to over 150 000 atm. The absorption edge of olivine shifts red by about 9% of the gap in this pressure range. The Fe^{++} peak in garnet shifts to higher energies by 700 cm^{-1} in 170 000 atm, due to increased splitting of the d-levels by the ligand field. This is consistent with previous experimental work on transition metals, and with available theory. The temperature coefficient of the absorption edge of olivine was also measured at atmospheric pressure to 327°C. It exhibited a linear shift of 4.21×10^{-4} eV/deg C over this range.

535.343 : 539.19

12052. THERMODYNAMIC AND SPECTROSCOPIC STUDY OF PYRROLIDINE. II. VIBRATIONAL SPECTRA AND CONFIGURATION. J.C.Evans and J.C.Wahr.
J. chem. Phys., Vol. 31, No. 3, 655-62 (Sept., 1959).

For Pt I, see Abstr. 12198. The Raman spectrum of pyrrolidine liquid at several temperatures and the infrared spectra of pyrrolidine in the vapour, liquid, and solid states, in the 320-3500 cm^{-1} region and over the temperature range +150°C to −120°C were recorded. Similar but less extensive studies were made on pyrrolidine N—D. Evidence for the presence of several configurational isomers in the liquid and solid states was obtained. A vibrational assignment, complete except for one degree of freedom, has been made and used to calculate the entropy of the ideal vapour. Comparison with the measured entropy has shown that pyrrolidine in the vapour is a free or an almost free pseudorotator.

535.343

12053. ROTATION SPECTRUM OF METHYL ALCOHOL.
D.G.Burkhard and D.M.Dennison.
J. molecular Spectrosc., Vol. 3, No. 4, 299-334 (Aug., 1959).

The rotation spectrum of methanol vapour has been measured from 50 to 457 cm^{-1}. Combining these data with the work of Borden and Barker provides an accurate map of the spectrum to 625 cm^{-1} together with some provisional observations between 695 and 860 cm^{-1}. The primary purpose of the theoretical discussion is to identify the observed lines and subsequently, through combination relations, to establish the rotational energy levels of the molecule. These levels may be labelled by the quantum number n, τ, K, and J . n corresponds roughly to a vibration in the hindering potential field and τ designates the three types of levels resulting from the threefold potential. J gives the total angular momentum and K its component along the molecular symmetry axis. The method of analysis consisted first in calculating the rotational levels using the barrier height and the moments of inertia established through earlier investigations of the microwave spectrum. The intensities of the lines occurring within the region of experimental observation were calculated. The resulting predicted spectrum when compared with the observed spectrum allowed a considerable number of identifications to be made but revealed deviations due to centrifugal force effects. These latter were then calculated and ultimately a very satisfactory fit was obtained. The rotational levels were then determined for n = 0, 1, 2, and 3 and for K = 0 through 10. The accuracy is estimated to be of the order of a few tenths of a wave per centimetre. The small discrepancies between these observed levels and the calculated levels (taking account of centrifugal distortion) are discussed and it is concluded that the hindering potential must be sinusoidal in form with an accuracy of better than one per cent.

535.343 : 539 19

12054. NONRESONANT MICROWAVE ABSORPTION AND ELECTRIC DIPOLE MOMENT OF NO IN THE GASEOUS STATE.
A.A.Maryott and S.J.Kryder.
J. chem. Phys., Vol. 31, No. 3, 617-21 (Sept., 1959).

The microwave absorption in NO was measured by a resonant cavity method at frequencies near 9 and 23 kMc/s and at pressures in the range 3 to 27 atm. The major part of the absorption is due to direct Λ-type doublet transitions, although at the higher pressures, a significant contribution also comes from the low frequency wings of the pure rotational spectrum. Since the Λ-doublet separation is much smaller than the applied frequency for all significant transitions, the resulting spectrum has the nonresonant or Debye shape. From the intensity of this spectrum, the electric dipole moment was found to be 0.148 ± 0.002 debye. The effective collision cross-section for random spacial reorientation of the molecules is approximately twice the kinetic collision cross-section.

535.343

12055. MILLIMETER-WAVE ROTATIONAL SPECTRUM OF NO IN THE $^2\pi_{3/2}$ STATE. P.G.Favero, A.M.Mirri and W.Gordy.
Phys. Rev., Vol. 114, No. 6, 1534-7 (June 15, 1959).

The $J = \frac{7}{2} \rightarrow \frac{5}{2}$ rotational transition of NO in the $^2\pi_{3/2}$ electronic state was measured in the 1.17 mm wave region. Theory applied to these measurements combined with previous measurements on transitions of the ground $^2\pi_{1/2}$ state lead to the following values for the characteristic constants of $N^{14}O^{16}$. The rotational constant B_0 = 50 848.42 Mc/s, and the spin–orbit coupling constant A = = 122.1 cm^{-1}. The N^{14} nuclear magnetic couplings a = 83.82 Mc/s, b = 68.49 Mc/s, c = −86.34 Mc/s, and the N^{14} nuclear quadrupole couplings eQq_1 = −2 Mc/s, eQq_2 = 22 Mc/s. The Λ-doubling constants p_Λ = 175.15 Mc/s, q_Λ = 1.15 Mc/s.

535.343 : 539.1

12056. MICROWAVE SPECTRUM AND STRUCTURE OF PERRHENYL FLUORIDE.
J.F.Lotspeich, A.Javan and A.Engelbrecht.
J. chem. Phys., Vol. 31, No. 3, 633-43 (Sept., 1959).

Rotational absorption lines of the symmetric-top molecule ReO_3F were observed in the K-band regions of 21 400 and 28 500 Mc with a Stark modulation spectrometer designed specially to accommodate this and other chemically reactive molecules. The spectrum exhibits a hyperfine structure arising from interaction of the Re nuclear electric quadrupole moment with the surrounding charge. The h.f.s. pattern establishes the Re nuclear spin as 5/2 and yields a quadrupole coupling constant $eqQ(Re^{187})$ = (−48.4 ± 1.3) Mc/s for the ground vibration state. Additional groups of lines associated with molecular states of vibrational excitation were also present. Of the six normal vibration frequencies, three were sufficiently low to contribute an observable fraction of molecules to their excited states: one nondegenerate, $\nu_3(a_1)$, and two doubly degenerate, $\nu_5(e)$ and $\nu_6(e)$. The corresponding rotation-vibration and l-type doubling constants were measured to be α_3 = (+12.30 ± 0.06) Mc/s, α_5 = (−10.91 ± 0.06) Mc/s, q_{l5} = (16.31 ± 0.25) Mc/s, α_6 = (+2.52 ± 0.06) Mc/s, q_{l6} = (5.00 ± 0.24) Mc/s. Strong dependence of quadrupole coupling on molecular vibration was observed, the values of $eqQ(Re^{187})$ being −27, −35, and −58 Mc/s respectively in the singly-excited states, ν_3, ν_5, and ν_6. Comparative measurements of line intensities relative to those of the ground vibration state yield the following approximate values for the three lowest normal vibration frequencies: ν_3 = (325 ± 40) cm^{-1}, ν_5 = (410 ± 25) cm^{-1}, ν_6 = (345 ± 40) cm^{-1}. Measurements of the Stark effect in ReO_3F give as the dipole moment of this molecule a value μ = (0.85 ± 0.05) debye. Precise determination of molecular structure was effected from frequency measurements of lines belonging to the slightly asymmetric top $ReO_3{}^{16}O^{18}F$. The results give Re—O = (1.692 ± 0.003) A, Re—F = (1.859 ± 0.008) A, F—Re—O = 109° 31' ± 16'. Comparison is made between these and the known values of two other structurally similar molecules, ReO_3Cl and MnO_3F. See Also Abstr. 12749.

535.34

12057. THE MICROWAVE SPECTRUM, STRUCTURE, AND DIPOLE MOMENT OF DISULFUR MONOXIDE.
D.J.Meschi and R.J.Myers.
J. molecular Spectrosc., Vol. 3, No. 4, 405-16 (Aug., 1959).

The microwave spectrum of the product resulting from the passage of an electrical discharge through a mixture of sulphur and SO_2 has been examined. This product, usually called "sulphur monoxid

was found to have a microwave spectrum which was assigned to disulphur monoxide with a bent S—S—O structure. The ground state rotational constants were established as A = 41 914.4_0, B = 5059.0_9 and C = 4507.1_4 Mc/s. Assignments were also made for an excited vibrational state and for the $S^{34}S^{32}O^{16}$ species. The structure of S_2O was established as S—O 1.46$_8$ ± 0.010 A, S—S 1.88$_4$ ± 0.010 A, and S—S—O 118°0' ± 30'. The components of the dipole moment were established as μ_A = 0.875 ± 0.01, μ_B = 1.18 ± 0.02 with μ(total) = 1.47 ± 0.02 Debye.

535.343

12058. EQUIVALENCE BETWEEN THE LINE WIDTH AND THE RATE OF ENERGY RELAXATION IN THE INVERSION SPECTRUM OF AMMONIA. K.Tomita.
Progr. theor. Phys., Vol. 17, No. 3, 513-15 (March, 1957).

This equivalence is proved under appropriate conditions for the experiment of Bleaney and Penrose (1947), using the method of Abstr. 2881 (1955). J.Hawgood

535.343.07

12059. TECHNIQUE FOR LIQUID PHASE SPECTROPHOTOMETRY AT ELEVATED TEMPERATURES AND PRESSURES. W.C.Waggener.
Rev. sci. Instrum., Vol. 30, No. 9, 788-93 (Sept., 1959).

A standard Model 14M Cary recording spectrophotometer has been equipped with a special cell assembly for studies of the liquid state, particularly of water and radioactive aqueous solutions over a working range from 0 to 250°C and from 0 to 1000 lb/in^2 (absolute). The stability and reproducibility of measurements are comparable to those obtainable at room temperature.

535.343.9 : 535.375

12060. THE EFFECT OF THE REFRACTIVE INDEX OF THE SCATTERING MEDIUM ON THE INTENSITY OF RAMAN LINES. A.I.Sokolovskaya and S.G.Rautian.
Optika i Spektrosk., Vol. 6, No. 1, 51-4 (Jan., 1959). In Russian.

Change of the refractive index of the scattering liquid may affect Raman line intensities by altering: (1) the reflection coefficient at the boundary liquid—glass (of the cell); (2) the configuration of rays of exciting light inside the cell; (3) the brightness of scattered radiation on leaving the cell; (4) the conditions of formation of the image of the cell at the spectrograph slit. It was found that only the effect (3) is important and needs to be allowed for. A.Tybulewicz

535.343.9 : 535.375.5

12061. ON THE EFFECT OF THE INTERNAL FIELD ON THE RAMAN SCATTERING INTENSITY. V.M.Pivovarov.
Optika i Spektrosk., Vol. 6, No. 1, 101-3 (Jan., 1959). In Russian.

A change in the refractive index of a medium produces a change in the intensity of the field of a light-wave acting on a molecule placed in that medium. This change is determined by the refractive index in the region of wavelengths of the scattered radiation. It affects the internal field acting on a molecule in the medium. The author considers this internal field and shows that the Raman line intensities should increase with increase of the refractive index of the medium and that the intensity of the depolarized lines should be affected more than the intensity of the polarized lines. These conclusions are confirmed by the author's study of the effect of the medium on the intensity of the 1707 cm^{-1} Raman line in pure acetone and in its 50% (by volume) mixtures with CCl_4 and n-hexane. A.Tybulewicz

535.343.9 : 535.375.5

12062. EXCITATION OF RAMAN SPECTRA AT HIGH PRESSURES. M.G.Gonikberg, Kh.E.Sterin, S.A.Ukholin, A.A.Opekunov and V.T.Aleksanyan.
Optika i Spektrosk., Vol. 6, No. 1, 109-10 (Jan., 1959). In Russian.

A steel cell is described for operation at pressures up to 2500 kg/cm^2. Using this cell, spectra of toluene and isopropylbenzene were obtained at pressures of 1000 and 2000 kg/cm^2 at room temperature. No displacement of the Raman frequencies was observed. A.Tybulewicz

535.343.9 : 535.375.5

12063. RAMAN SPECTRA OF COMPLEX COMPOUNDS CONTAINING $SbCl_3$ AND $SnCl_4$. Sh.Sh.Raskin.
Dokl. Akad. Nauk SSSR, Vol. 123, No. 4, 645-7 (Dec. 1, 1958). In Russian.

Complex compounds of $SbCl_3$ with naphthalene ($2SbCl_3.C_{10}H_8$) and diphenyl ether [$2SbCl_3.(C_6H_5)_2O$] were studied. Two typical changes from the spectra of the components were found: (a) widening of the lines and a frequency shift; (b) appearance of new lines. A short discussion of these results with reference to possible structural alterations is given, and a comparison is made with the spectra of $SnCl_4.5H_2O$. G.Martelli

535.343.9 : 535.375.5

12064. THE TEMPERATURE DEPENDENCE OF RAMAN LINE INTENSITIES IN GASEOUS CO_2 AND N_2. B.M.Pivovarov and Ya.S.Bobovich.
Optika i Spektrosk., Vol. 6, No. 2, 249-50 (Feb., 1959). In Russian.

The authors found earlier [Optika i Spektrosk., Vol. 3, 227 (1957)] that the Raman line intensities in liquids decrease with increase of temperature, contradicting the theory of Raman scattering. In order to determine whether this anomalous behaviour is due to interactions between molecules in the condensed (liquid) phase, the authors studied the effect of temperature on the Raman line intensities in gaseous CO_2 and N_2. Intermolecular interactions are practically absent in gases and the Raman scattering intensities should increase with temperature. The authors found that, in fact, at temperatures up to 120°C there was no noticeable change in the intensities of the lines studied. This is taken as confirming that there is no temperature anomaly in the behaviour of the Raman line intensities in gases, since only a negligibly small increase of intensity could be expected on increase of temperature up to 120°C. Consequently the results obtained do not contradict the hypothesis that the temperature anomalies of the Raman line intensities in liquids are due to intermolecular interactions. A.Tybulewicz

535.345

12065. INFRARED TRANSMISSION SPECTRA OF POROUS AND QUARTZ-LIKE GLASS. N.A.Sevchenko and V.A.Florinskaya.
Optika i Spektrosk., Vol. 4, No. 2, 189-95 (Feb., 1958). In Russian.
English summary: PB 141047T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The transmission of porous and quartz-like glasses (made from sodium borosilicate glasses) was investigated using either thin layers of powder on KCl plates or thin films. In all cases very strong bands at 9 μ and 21-22 μ were observed, as well as medium intensity bands at 7.2, 12.5 and 10.8 μ. In addition to these bands, porous glass exhibited weak bands at 3 and 6.2 μ. A discussion is given of the possible origin of these bands, and of similar bands in B_2O_3—SiO_2 glass. R.D.Hudson

535.345

12066. MONOCRYSTALS OF ZnS AND THE SPECTRUM OF THEIR ABSORPTION EDGE AT LOW TEMPERATURES. E.F.Gross and L.G.Suslina.
Optika i Spektrosk., Vol. 6, No. 1, 115-17 (Jan., 1959). In Russian.

Zn monocrystals were produced by sublimation of very pure powder in an atmosphere of argon. The monocrystals were in the form of colourless plates of 25 × 5 mm area and their thickness varied from 0.1 mm to 0.1 μ. They were found to be uniaxial (hexagonal modification of ZnS) and their optical axes lay in the plane of the crystals. Using crystals of various thicknesses the authors studied the absorption spectra in the region of 3300-3100 A. The structure of the long-wavelength edge of absorption was found to be clearly exhibited at liquid-helium temperature (4.2°K). Heating of crystals from 4.2 to 77°K and then to 20°C displaces the absorption lines towards longer wavelengths and makes them less distinct. A.Tybulewicz

535.345

12067. ABSORPTION BY GASEOUS HELIUM IN THE EXTREME ULTRAVIOLET. N.N.Axelrod and M.P.Givens.
Phys. Rev., Vol. 115, No. 1, 97 (July 1, 1959).

The absorption by gaseous helium at room temperature was studied in the spectral region 550 A to 150 A. The measurements of Lee and Weissler were confirmed and extended. The data are in substantial agreement with the theoretical predictions of Huang.

535.345

12068. OPTICAL AND MAGNETO-OPTICAL ABSORPTION EFFECTS OF GROUP III IMPURITIES IN GERMANIUM. P.Fisher and H.Y.Fan.
Phys. Rev. Letters, Vol. 2, No. 11, 456-8 (June 1, 1959).

Measurements are reported on the ionization and excitation spectra of group III impurities in germanium at 5°K between 100 and 200 microns. The authors have also studied the Zeeman effect on the excitation lines of boron-doped germanium between 50 and

170 microns. The observed splitting is compared with the predictions of Luttinger's theory for the effect of a magnetic field on the degenerate valence band of germanium. D.L.Greenaway

535.345

12069. ELECTRICAL, OPTICAL AND ELASTIC PROPERTIES OF DIAMOND TYPE CRYSTALS. III. LIGHT ABSORPTION AND DISPERSION. V.S.Mashkevich.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 108-15 (1959). In Russian.

For Pt II, see Abstr. 5462 (1958). The dispersion, double refraction and single photon absorption of light in the infrared region due to lattice vibrations were studied. The parameters of the theory were determined and a numerical calculation of these effects was performed.

535.345 : 537.311.33

OPTICAL PROPERTIES OF GeS. See Abstr. 11013

535.345 : 538.2

DE HAAS–VAN ALPHEN TYPE OSCILLATIONS IN THE INFRARED TRANSMISSION OF BISMUTH. See Abstr. 11204

535.345.6

12070. ON THE CONVERSION OF THE SPECTRAL SENSITIVITY OF A PHOTOELECTRIC RECEIVER TO A GIVEN SENSITIVITY CURVE. K.Corduan.
Tech. wiss. Abhandl. Osram-Gesell., Vol. 7, 314-23 (1958).
In German.

Discusses the design of a set of filters partially covering a selenium photocell to convert its spectral response to that of the eye. G.F.Lothian

535.345.6

12071. THEORY OF THE DISPERSION FILTER (CHRISTIANSEN COLOUR FILTER). W.Schrader.
Optik, Vol. 15, No. 5, 265-74 (May, 1958).

A simple diffraction theory for the half-width of the spectral range of the transmissivity of the filter is developed. The results of this theory agree with a different derivation due to Raman. The theory is confirmed by experiment when the dependence on size of grain, layer thickness, and temperature is taken into consideration.

535.345.6

12072. A POLARIZATION INTERFERENCE FILTER.
F.Bayer-Helms.
Optik, Vol. 16, No. 8, 472-84 (Aug., 1959). In German.

The properties are described of an Evans filter consisting of three split elements (Abstr. 3158 of 1940). It is shown that the degree of transmission of this filter can be doubled by the use of polarizers of the Wollaston type.

535.361.2

12073. ANGULAR DISSYMMETRY OF THE CRITICAL OPALESCENCE IN LIQUID MIXTURES. P.Debye.
J. chem. Phys., Vol. 31, No. 3, 680-7 (Sept., 1959).

Visible light scattered by a one-component homogeneous liquid in the vicinity of its critical point or by a homogeneous mixture of two liquids in the vicinity of their critical mixing temperature shows angular dissymmetry which becomes the more pronounced the nearer the temperature comes to the critical temperature. It is shown how this dissymmetry can be used as a measure for the range of molecular forces in the case of ordinary molecules. In the case of polymer molecules, observation of the dissymmetry provides a method for measuring the size of polymer coils in a size range too small to be measured by the usual dissymmetry method applied to diluted solutions.

535.37

12074. REMARKS ON GLOW CURVE THEORIES. M.Schön.
Tech. wiss. Abhandl. Osram Gesell., Vol. 7, 175-84 (1958).
In German.

A critical survey of glow curve equations for various conditions such as mono- and bi-molecular cases is made. It is shown that the trap depth cannot be easily determined from maximum glow temperatures but can be obtained if the shift of the peaks with change in rate of warming is studied. Theoretical formulae are much simplified if a non-linear rate of warming can be assumed, in particular one which varies as the inverse of the absolute temperature.
G.F.J.Garlick

535.37

12075. POLARIZATION OF LUMINESCENCE EXCITED BY POLARIZED AND NATURAL LIGHT.
A.N.Sevchenko and G.P.Gurinovich.
Dokl. Akad. Nauk SSSR, Vol. 123, No. 1, 60-3 (1958). In Russian.

Vavilov and Levshin's formula [Z. Phys., Vol. 16, 135 (1923)] $P_n = P_p/(2 - P_p)$, where P_n and P_p are the degrees of polarization of luminescence excited by natural and polarized light, respectively, is applicable only (1) when the angle between the direction of observation and that of the exciting light is 90°, and (2) when the medium involved is isotropic and the absorption and emission are of dipole nature. The authors derive formulae for isotropic solutions and for crystals of the cubic systems (multipole systems). Calculations are made of the electric and magnetic dipoles, electric quadrupoles, and electric and magnetic circular oscillators. F.Lacnmar

535.37

12076. LUMINESCENCE AND RESONANCE SCATTERING.
L.N.Ovander.
Optika i Spektrosk., Vol. 5, No. 1, 10-14 (1958). In Russian.
English summary: PB 141047T-6, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

In a theoretical study of resonance scattering it is shown that a continuous transition between luminescence and resonance scattering is possible in principle. R.W.Nicholls

535.37 : 539.2

12077. A PHOSPHOR MODEL ON A QUANTUM-MECHANICAL BASIS. V. PROBABILITY OF THERMAL ELECTRON PROCESSES AT THE RECOMBINATION CENTRE. H.Stumpf.
Z. Naturforsch., Vol. 14a, No. 4, 403-14 (April, 1959). In German.

The matrix elements for electron transitions between the conduction band and the ground state of an anion vacancy are zero. Transitions are therefore only possible as a result of thermal agitation and the transition probability is calculated by a method described in an earlier paper (Abstr. 3325 of 1959). Thermal transitions yield energy, and since the energy difference between initial and final states largely determines the transition probability, a calculation is made of these differences. Simple approximations for the subsequent evaluation of the Franck—Condon integrals are justified. The capture probability into the ground state as well as the ionization probability from the ground state are derived.
R.Parker

535.37 : 578.084

DIFFERENTIAL MICROFLUORIMETER. See Abstr. 11671

535.37

12078. NOTE ON THE THEORY OF THE SELF-DEPOLARIZATION OF PHOTO-LUMINESCENCE OF SOLUTIONS.
C.Bojarski.
Bull. Acad. Polon. Sci. Ser. Sci. math. astron. phys., Vol. 6, No. 11, 719-25 (1958).

It is shown that the general expression, derived by Jablonski in his theory of the self-depolarization of photoluminescence of solutions, can be presented in a simpler form valid for both low and high concentrations. The theory shows good agreement with published experimental data. J.B.Birk

535.

12079. ON THE RADIATION FROM [FLUORESCENT] LUMINOUS SUBSTANCES IN MERCURY LOW PRESSURE DISCHARGES. G.Kressin.
Tech. wiss. Abhandl. Osram-Gesell., Vol. 7, 235-40 (1958). In German.

Describes a photometer arrangement for the measurement of fluorescence in various substances excited by a Hg discharge. Data are given for rates of decay of light intensity on a function of exposure time. Various luminous substances were studied.
J.D.Craggs

535.37

12080. MECHANISM OF THE LUMINESCENCE OF SILVER HALIDES AND MIXTURES. Z.Matyáš.
Semiconductors and phosphors (see Abstr. 9597 of 1959) pp. 426-8.
In German.

The recombination centres for electrons and holes in AgCl and AgBr are discussed. It is concluded that at very low temperatures

electrons recombine with holes in positive ion vacancies while at higher temperatures (~ 100°K) only recombination centres arising from incipient vacancies are stable. G.F.J.Garlick

535.37

12081. LUMINESCENCE STUDIES IN COMMERCIAL PHOTOGRAPHIC EMULSIONS. R.Meyer.
Z. wiss. Photogr., Vol. 53, No. 7-9, 141-56 (1959). In German.

Luminescence spectra etc. are examined for various commercial films and compared with the unbound silver halides. A strong green emission band and a weaker yellow band were found with decay times of the order of a millisecond. The green luminescence decreased with continual ultraviolet irradiation. Infrared quenching of the green luminescence was observed and the latter was susceptible to surface impurities. Exposure of the emulsions at room temperature enhances the luminescence for short exposure times but excessive exposure causes quenching. G.F.J.Garlick

535.37

12082. ON THE SO-CALLED PRESSURE DESTRUCTION AND PRESSURE COLORATION OF LUMINESCENT MATERIALS.
A.Schleede and J.Schleede-Glassner.
Tech. wiss. Abhandl. Osram-Gesell., Vol. 7, 200-8 (1958). In German.

Former work on sulphides and halides is reviewed. Experiments on ZnS:Cu (wurtzite) gave large losses of efficiency by wet or dry milling, and eventually the crystal structure showed only those lines in the pattern common to cubic and hexagonal, though the lines peculiar to the cubic form were not developed. For $(Zn,Be)_2SiO_4$:Mn much smaller changes of efficiency occurred, and the powder photograph retained the phenacite structure. The phosphors could be partially restored by heating. S.T.Henderson

535.37

12083. CHEMISTRY OF LUMINESCENT CENTRE FORMATION IN II-VI COMPOUNDS. N.Riehl.
Semiconductors and phosphors (See Abstr. 9597 of 1959) pp. 35-44. In German.

See Abstr. 4177 (1957). Earlier opinions on the chemical nature of the activator centre in luminescent ZnS are briefly mentioned, and experiments described to support the view that coactivators are not always necessary, and that the green Cu centre consists of two Cu^+ ions close to a sulphur vacancy. These vacancies arise in pure ZnS by firing in HCl or H_2 in the complete absence of O_2 or H_2O, and Cu may then diffuse in at low temperatures to give green or blue luminescence according to the prefiring temperature (below or above 1050°C). The blue luminescence of "non-activated" ZnS can only be produced if oxygen is present in some form during the firing process. The attempted incorporation of a trivalent coactivator (radioactive labelled Y) showed that practically none of it entered the ZnS lattice. S.T.Henderson

535.37 : 537.312.5

12084. FLUORESCENCE AND PHOTOCONDUCTIVITY IN Ag-ACTIVATED Zn-Cd SULPHIDES. W.v.Gool.
Semiconductors and Phosphors. (See Abstr. 9597 of 1959), pp. 602-9. In German.

Some phosphors were made from CdS activated with Ag—Ga and Ag—Cl. These phosphors showed two fluorescence bands at low temperatures: 6200 and 7300 A. The 6200 A emission was only found when the activator concentration (Ag) was greater than the activator concentration (Cl or Ga). By making a series of mixed crystals (Zn, Cd)S it was shown that the 7300 A emission corresponds to the 4500 A emission in ZnS (sphalerite) and therefore to the normal silver centre (Ag^+ at a lattice site). The 6200 A emission in CdS is connected with 3950 A (sphalerite) or 3850 A (wurtzite) in ZnS. The experimental conditions necessary to obtain the short-wave emission (Ag > Ga) indicate that the short-wave fluorescence centre is formed by interstitial silver, by a sulphur vacancy or by an association containing at least one of these defects. It is also clear that the inversion of the normal band model proposed by Lambe and Klick (1955) may be possible for the short-wave centre (6200 A in CdS, 3950 A in ZnS); there are no indications, however, that the band model of the normal silver centre (7300 A in CdS, 4500 A in ZnS) ought to be changed.

535.37

12085. THE TEMPERATURE DEPENDENCE OF THE PHOTOLUMINESCENCE OF SILVER-ACTIVATED ZINC-CADMIUM SULPHIDES. I.Soudek.
Czech. J. Phys., Vol. 8, No. 1, 66-80 (1958). In German.

Five samples of ZnS or ZnCdS were excited by long wavelength u.v. and their light output measured at a single wavelength in each experiment during temperature cycles to about 200° C. Some heating and cooling curves coincided, but often on cooling the original output was regained more slowly. This hysteresis effect was attributed to traces of copper in the phosphors. Excessive heating produced permanent losses in the fluorescence. The temperature dependence varied for different emission wavelengths in the same phosphor, showing the presence of subsidiary bands. The non-linear response to altered irradiation intensity was also studied. S.T.Henderson

535.37

12086. INFLUENCE OF HYDROGEN ON THE RED ZnS-Cu FLUORESCENCE. W.van Gool and A.P.D.M.Cleiren.
J. Electrochem. Soc., Vol. 106, No. 8, 672-6 (Aug., 1959).

Self-coactivated ZnS:Cu phosphors were made by firing in different atmospheres. When H_2S/H_2 mixtures were used, the red fluorescence decreased with increasing amounts of hydrogen. With A/S_2 or with N_2/S_2 atmospheres no red fluorescence was obtained. These experimental results can be summarized by stating that, in order to obtain the red fluorescence, hydrogen must be incorporated into the phosphor and the sulphur pressure must be sufficiently high. The hydrogen either forms a part of the red centre or it destroys or replaces a killer centre that prevents the occurrence of red fluorescence when hydrogen is absent. In connection with the high sensitivity of the red fluorescence to small amounts of impurities it is suggested that the concentration of the red centres is much smaller than the amount of incorporated copper.

535.37

12087. THE EFFECT OF TEMPERATURE ON THE RECOMBINATIVE INTERACTION OF BLUE AND GREEN LUMINESCENCE CENTRES IN A ZnS:Cu PHOSPHOR. L.A.Vinokurov and M.V.Fok.
Optika i Spektrosk., Vol. 4, No. 1, 118-21 (Jan., 1958). In Russian. English summary: PB 141047T-3, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

An extension of previous theoretical work (see Abstr. 586 of 1958) to the case of exciting radiation being absorbed by both types of centre. The expressions derived give fair agreement with experimentally found variations in intensities of green and blue luminescence with excitation level at different temperatures for a ZnS phosphor with ~ 10^{-7} g/g Cu. Lack of exact agreement is ascribed to neglect of the possibility of external quenching. C.H.L.Goodman

535.37

12088. ON THE SPATIAL DISTRIBUTION OF EMISSION OF PHOSPHOR POWDERS. A.P.Ivanov.
Optika i Spektrosk., Vol. 4, No. 6, 767-71 (June, 1958). In Russian. English summary: PB 14107T-11, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Unpolarized fluorescence emission from a non-scattering volume element is isotropic (Lommel's law). This law is not obeyed if the fluorescence is polarized, or is emitted by the plane surface of a transparent medium, due to internal reflection. The angular distribution of the intensity of luminescence of powders was measured. It depends both on the layer thickness and on particle dimensions and obeys a law intermediate between Lommel's and Lambert's laws. The angular distribution of luminescence of a non-scattering plane-parallel plate is close to the Lambert distribution. J.B.Birks

535.37

12089. ELECTRIC FIELD ENHANCEMENT OF CATHODOLUMINESCENCE (CATHODOELECTROLUMINESCENCE).
P.M.Jaffe.
J. Electrochem. Soc., Vol. 106, No. 8, 667-72 (Aug., 1959).

The application of an alternating electric field to certain cathode-ray excited ZnCdS:Mn,Cl powder phosphors causes the cathodoluminescence to be enhanced. Enhancement is a function of the frequency and strength of the applied field, the beam current density, and the accelerating potential. The indications are that the effect is in reality cathode-ray induced electroluminescence. Similar testing of a ZnCdS:Mn,Au,Cl phosphor results in either enhancement or quenching depending upon the exciting conditions.

535.37 : 537.312.5

12090. CERTAIN LUMINESCENT AND PHOTOELECTRIC PROPERTIES OF POLYCRYSTALLINE CADMIUM SELENIDE.
N.A.Tolstoi and V.A.Sokolov.

Optika i Spektrosk., Vol. 3, No. 5, 495-503 (Nov., 1957). In Russian.

Reports steady-state and relaxation properties of luminescence and photoconductivity of polycrystalline CdSe. Positive and negative flashes on the rise and decay curves of photoconductivity were observed. Ultraviolet light was found to quench photoconductivity. The steady-state photoconductivity C was found to be related to the exciting light intensity E by $C \propto E^q$, where $q > 1$. The exponent q reaches a maximum ($q = 2$) at -15°C, and the photoconductivity rise curve is then parabolic. A.Tybulewicz

535.37

12091. QUENCHING FACTORS IN THE FLUORESCENCE OF CdS:Ag. M.Grillot-Bancie.
Semiconductors and phosphors. See Abstr. 9597. pp. 610-13. In French.

The effects on the luminescence efficiency of CdS:Ag phosphors of variations in the Ag activator content, and in the temperature of calcination were studied. Radiochemical tracer techniques have shown that the Ag content is independent of the calcination temperature, so the quenching effect of raising the calcination temperature is attributed to lattice defects. J.B.Birks

535.37

12092. TWO METHODS OF PREPARING LUMINESCENT POWDERS. G.Monod-Herzen, Nguyen Chung-Tu and H.Mulot.
Bull. Soc. Chim. France, 1959, No. 6, 1019 (June). In French.

To prepare CdI_2 activated with small amounts of PbI_2 as a fine homogeneous powder, the PbI_2 is dissolved in acetone to which the CdI_2 is then added and the solution stirred. The stirring is continued until the acetone has completely evaporated. Powders with high activator concentrations are prepared by grinding the mixtures in a glass mortar, adding ethyl alcohol to form a paste, and allowing to dry in an oven for a day. J.Franks

535.37

12093. ON LOW-TEMPERATURE LUMINESCENCE OF CuBr. P.Shvist.
Optika i Spektrosk., Vol. 4, No. 6, 801-3 (June, 1958). In Russian. English summary: PB 141047T-11, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

CuBr with a surface free of oxidation products and adsorbed gases was prepared by vacuum decomposition of $CuBr_2$. Freshly prepared CuBr at 77° K does not luminesce in vacuum, but blue luminescence, with 5 narrow bands (4175-4281 A) and a broad band (4430 A), appears when air is admitted to the vessel. The cycle of evacuation and admission of air can be repeated several times with similar results, and it is concluded that the low-temperature luminescence of CuBr is related to surface effects due to gas adsorption. J.B.Birks

535.37

12094. KINETICS OF LUMINESCENCE OF CERTAIN TUNGSTATES AND OF ZINC OXIDE. V.A.Arkhangel'skaya and N.A.Tolstoi.
Optika i Spektrosk., Vol. 5, No. 4, 415-22 (1958). In Russian.

The authors studied relaxation of photoluminescence and cathodoluminescence of $CaWO_4$, $CdWO_4$, $MgWO_4$, $ZnWO_4$, $CaMoO_4$ and ZnO, using a modified "taumeter" method. The cathodoluminescence relaxation curves of all the six phosphors were not of purely exponential nature, in contrast to the photoluminescence relaxation, which was exponential. A.Tybulewicz

535.37

12095. THE FLUORESCENCE OF BINARY AND TERNARY GERMANATES OF GROUP II ELEMENTS. H.Koelmans and C.M.C.Verhagen.
J. Electrochem. Soc., Vol. 106, No. 8, 677-82 (Aug., 1959).

The fluorescence of binary and ternary germanates of Ca, Sr, Ba, Mg, and Zn with different activators was investigated. Germanate phosphors activated with Pb, Tl, and Mn are described. The ternary composition triangles are given together with the X-ray powder-diagrams of 23 hitherto unknown germanates.

535.37

12096. CONFIGURATIONAL COORDINATE CURVES FOR LUMINESCENCE CENTER IN $Ca_3(PO_4)_2$:Cu. K.Maeda.
J. Phys. Soc. Japan, Vol. 14, No. 4, 478-86 (April, 1959).

Measurements of spectral distributions of luminescence, reflectivity and quantum efficiency, temperature dependence of luminescence intensity and decay constants were made. The one-dimensional configurational coordinate curves for the luminescence centre in this phosphor were determined by analysing spectral data. Some characteristics expected from these curves are compared with those observed; agreement in the absorption bandwidth and disagreement in the activation energy for non-radiative transition are obtained. The relations between one- and many-dimensional models are investigated and the cause of the above disagreement is attributed to the simplicity of the model assumed. The non-radiative transitions in this luminescence centre are also discussed.

535.37

12097. PRESSURE EFFECTS IN LUMINESCENCE: ISOBARIC EXPERIMENTS ON NaI(Tl). L.Reiffel.
Phys. Rev., Vol. 114, No. 6, 1493-9 (June 15, 1959).

The effect of steady-state hydrostatic pressure on the properties of luminescent systems, with particular reference to the phosphorescence of NaI(Tl), is examined. It is shown that readily observable changes in decay mean life may be produced by very modest pressures. An interpretation of these effects is developed from a configurational coordinate model and also from thermodynamic considerations. Experimental results are in good agreement with these theoretical expectations. For a 0.66 eV trap in NaI(Tl), the change in centre volume at the point of transition from metastable to emitting state is found to be $+17.5 \times 10^{-24}$ cm^3. Assuming a specific model for the centre allows computation of the sign and magnitude of the critical displacement of ions required for trap collapse — in this case +0.19 A. The force constant of the metastable state is computed is be 5.8×10^5 dyn/cm; and the vibrational frequency, assuming an effective mass equal to six I^- ions, is 3.4×10^{12} sec^{-1} corresponding to a zero point energy for this trap of 0.007 eV and cross over at a vibrational quantum number of about 47. The transmission coefficient for cross-over to the emitting state appears to be of the order of 0.03%. Other possible experiments involving steady-state or transient pressure effects are outlined.

535.37

12098. THE DEPOLARIZATION OF THE SODIUM RESONANCE FLUORESCENCE. W.Ermisch and R.Seiwert.
Ann. Phys. (Leipzig), Folge 7, Vol. 2, No. 7-8, 393-402 (1959). In German.

Earlier work is reviewed. The fluorescence of Na vapour was observed at right angles to the exciting beam of polarized Na radiation, and at right angles to an impressed magnetic field. Measurements were made to about 200° C and 275 G. The polarization decreased with the density of the vapour and increased with the field to a saturated value at about 180 G for any value of the density. Extrapolation to zero vapour density gave polarization of 15% at H = 0 and 40% at H = 180; it was only 5% for H = 180 with 6×10^{12} particles/cm^3, but even at 10^{10} particles/cm^3 the value was reduced below 40%, though depolarization by collision would not be expected. The effect is attributed to "radiation diffusion", whereby the fluorescent light is absorbed and re-emitted as fluorescence of the second or higher order. S.T.Henderson

535.37

12099. THE FLUORESCENCE AND PHOSPHORESCENCE OF BIACETYL VAPOR AND ACETONE VAPOR. J.Heicklen.
J. Amer. Chem. Soc., Vol. 81, No. 15, 3863-6 (Aug. 5, 1959).

The fluorescence and phosphorescence of biacetyl have been studied at 40° as a function of pressure and incident wave length from 4358 to 3020 A. A mechanism is proposed which explains both the light emission and the photochemistry. With incident radiation of 3020 or 3130 A, the absorption is into a second excited electronic state. This state is converted to the first excited singlet and triplet states, and the same emission is observed as with radiation of longer wave lengths. The light emission from acetone has been studied with incident radiation from 2800 to 3130 A. The fluorescence efficiency is independent of pressure and nearly independent of exciting wavelength. The phosphorescence increases markedly with wavelength and with pressure at short wave lengths. With incident radiation of 3130 A and at 40°, the phosphorescence decreases slightly as the pressure increases. At 63° quenching is more pronounced.

535.37

12100. UNIQUE LUMINESCENCES OF DRY CHLOROPHYLLS. J.Fernandez and R.S.Becker.
J. chem. Phys., Vol. 31, No. 2, 467-72 (Aug., 1959).

Dry chlorophylls a and b in a rigid glass hydrocarbon solvent have intense emission at 7550 A and 7330 A, respectively. In each

case, the room temperature absorption spectra show the presence of a band shoulder on the long wavelength side of the main red band. Both the emission and the absorption bands disappear in the presence of hydroxyllic solvents. The absorption and emission are interpreted as $n-\pi^*$ singlet and $n-\pi^*$ triplet transitions, respectively. The lifetime of the $n-\pi^*$ triplet emission in chlorophyll a is estimated to be 10^{-3} sec. Cu chlorophyll b has an intense phosphorescence at 8740 A with a lifetime of less than 10^{-4} sec. The differences in the room temperature emission spectra for chlorophylls a and b are discussed.

535.37

12101. EXPERIMENTAL CONTRIBUTION TO ENERGY TRANSPORT MECHANISMS IN POLYSTYRENE PHOSPHORS.
H.K.Bothe and L.Herforth.
Semiconductors and phosphors (see Abstr. 9597 of 1959) pp. 439-44. In German.

The X-ray excited luminescence of anthracene dissolved in polystyrene is investigated when a second luminescent impurity is present such as chrysene. The results are interpreted in terms of the Birks photon cascade theory (Abstr. 8191 of 1954).
G.F.J.Garlick

535.37

12102. ON THE QUESTION OF ENERGY TRANSFER IN ORGANIC CRYSTALS. A.Schmillen.
Semiconductors and phosphors. (See Abstr. 9597 of 1959) pp. 445-50. In German.

Experiments on the variation of fluorescence with wavelength and concentration of dissolved impurity indicated that excitons play a dominant role in the transfer of energy. B.T.M.Willis

535.37

12103. EMISSION ANISOTROPY OF PHOTOLUMINESCENCE OF ACRIDINE YELLOW IN GELATINE IN THE PRE-EXCITED STATE.
M.Frączkowiak, J.Grzywacz and J.Heldt.
Bull. Acad. Polon. Sci. Ser. Sci. math. astron. phys., Vol. 7, No. 5, 295-300 (1959).

The phosphor was pre-excited by natural or plane-polarized white light, then excited by plane-polarized light of a suitable wavelength. Anisotropy in the emission, measured for various wavelengths and for the whole band, was found to be independent of the relative polarization of pre-exciting and exciting light, but to depend on the time of the pre-excitation, during which an equilibrium was reached between normal and "deformed" luminescent centres. The latter produced lower anisotropy and a somewhat different emission band. The anisotropy varied with wavelength in the emission band for any period of pre-excitation. S.T.Henderson

535.37

12104. THE EXTINCTION OF PHOTOLUMINESCENCE IN STILBENE BY EXTRANEOUS SUBSTANCES.
A.P.Kilimov and N.P.Shimanskaya.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 1, 24-8 (1958). In Russian. English summary: PB 141041T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Additions of benzoin, deoxybenzoin and hydrobenzoin to stilbene quenched the photoluminescence, whereas it was enhanced by 1,2 dibenzylpinacone, 1,2 dibenzylethane and phenanthrene. A comparison of the emission spectrum of pure stilbene with the spectra of stilbene containing phenanthrene and deoxybenzoin indicates that energy is transferred from the stilbene to the impurity molecules. The other impurities have little effect on the stilbene spectrum.
J.Franks

535.37

12105. QUENCHING OF PHOTOLUMINESCENCE OF LIQUID AND RIGID SOLUTIONS. J.Głowacki and R.Pohoski.
Bull. Acad. Polon. Sci. Ser. Sci. math. astron. phys., Vol. 7, No. 5, 301-5 (1959).

An attempt is made to check Jablonski's theory that a luminescent centre consists of an excited molecule enclosed in solvent layers containing quenching molecules. Dyes were used in solution in alcohol or in perspex, with rhodamine B as quencher. Theoretical curves were calculated for fluorescent yield v. quencher concentration on the assumption that quenching is proportional to the inverse sixth power of the distance between quencher and excited molecules. Agreement with experiment is good except that for liquid solutions the yield is higher than that predicted at high quencher concentrations, possibly because of lowering of the pH of the dye solution by rhodamine B. S.T.Henderson

535.37

12106. STUDY OF TRANSFERS OF ACTIVATION IN MOLECULAR CRYSTALS, STARTING FROM RETARDED FLUORESCENCE OF IMPURITIES IN SOLID SOLUTION.
A.Rousset, R.Lochet, R.Lacueille and Y.Meyer.
C.R. Acad. Sci. (Paris), Vol. 248, No. 14, 2045-8 (April 6, 1959). In French.

The change of fluorescence of anthracene from blue to green as naphthacene is added is not due to transfer of excitation energy to the naphthacene molecules in solid solution, but to direct excitation of the additive, which forms solid solutions (of blue fluorescence) only up to 10^{-6} concentration in anthracene. Similar effects are found for anthracene in solid solution in naphthalene. Phosphoroscope experiments allow the direct fluorescence of the components (time $\sim 10^{-8}$ sec) to be eliminated, and retarded emissions of different spectral composition to be observed up to 10^{-3} sec. Preliminary measurements on decay are contrary to Birks' photon theory of excitation. S.T.Henderson

535.37

12107. LUMINESCENCE OF SOME AROMATIC HYDROCARBONS IN SOLUTION IN PARAFFINS AT 77°K. A.Ciais and L.Pesteil.
C.R. Acad. Sci. (Paris), Vol. 248, No. 9, 1311-14 (March 2, 1959). In French.

The luminescence spectra were obtained of naphthalene, acenaphthene, anthracene and phenanthrene in solid solution in paraffins. The effect of the polarizability of the solvent and the intermolecular distance on the structure of the spectra is discussed.
J.Franks

535.37 : 539.17

THE LOWER EXCITED STATES AND THE PHOSPHORESCENT STATE OF DIPHENYL. See Abstr. 11534

535.37

12108. THE LUMINESCENCE OF COMPLEX MOLECULES IN RELATION TO THE INTERNAL CONVERSION OF EXCITATION ENERGY. I. R.M.Hochstrasser.
Canad. J. Chem., Vol. 37, No. 8, 1367-72 (Aug., 1959).

The relative fluorescence yields of a variety of double molecules were measured as a function of the wavelength of exciting light. In some cases the yield from the second excited state is lower than from the first. This effect is attributed to either photodecomposition or to the enhancement of intramolecular energy transfer processes which can compete with the internal conversion between the excited singlet states. The experiments on bianthrone have suggested a method of elucidating the mechanism of the photochromic isomerization of this compound.

535.37 : 537.312.5

12109. THE POSSIBILITY OF USING PULSE LAMPS FOR THE STUDY OF THE RELAXATION OF LUMINESCENCE AND OF PHOTOCONDUCTIVITY. N.A.Tolstoi.
Optika i Spektrosk., Vol. 4, No. 2, 279-281 (Feb., 1958). In Russian. English summary: PB 141047T-1, obtainable from Office of Technical Services, U.S.Dept. of Commerce, Washington, D.C., U.S.A.

The previously described "tau-meter" (Abstr. 2784 of 1948) and capacitor (Abstr. 2994 of 1932)methods of measurement of luminescence and photoconductive relaxation times has been used to study both potassium uranyl sulphate, and phosphors of the ZnS group. The time constants for the luminescence of the potassium salt are found by means of the tau-meter to be the same for all the emission bands. In all the ZnS group materials examined a considerable capacitor effect was found in the long wavelength region. It was possible in these observations to distinguish between a stimulated infrared photoeffect (the liberation of carriers trapped on earlier short wavelength excitation) and a direct infrared photoeffect. K.N.R.Taylor

535.37 : 537.531

12110. INTENSITY OF FLUORESCENT X-RAY LINES FROM A HOMOGENEOUS BINARY SAMPLE.
E.J.Suoninen and L.P.Hyvärinen.
Ann. Acad. Sci. Fennicae A VI, No. 23, 14 pp. (1959).

A formula is derived for the intensity of a fluorescent line of an element in an homogeneous mixture of two elements. Indirect excitation by the other element of the mixture is taken into account.

The result includes as parameters the absorption and excitation characteristics of the incident, intermediate and final fluorescent radiation. The numerical results of the application of the formula to the Cu–Zn binary alloys are given. A comparison with measured values shows moderately good agreement.

535.37

12111. THE EMISSION SPECTRUM OF COPPER-ACTIVATED ZINC SULPHIDE IN THE REGION OF PARTIAL THERMAL QUENCHING. H.P. de la Garanderie and D.Curie.
C.R. Acad. Sci. (Paris), Vol. 248, No. 22, 3151-3 (June 1, 1959). In French.

The emission spectrum of a phosphor such as KCl:Tl can be attributed to interactions between the luminescence centres and lattice vibrations, the theory leading to a gaussian spectrum which broadens with temperature increase. For photoconducting phosphors like ZnS:Cu it is simpler to postulate a gaussian distribution of centres in the forbidden band. The authors have demonstrated, by studying the temperature variation of the intensity and the spectral bandwidth in a specimen containing only "green" centres, that the former hypothesis is the more satisfactory for ZnS:Cu as well as KCl:Tl. I.Cooke

535.37 : 541.141

12112. THE PHOTOLYSIS AND FLUORESCENCE OF ACETONE AND ACETONE–BIACETYL MIXTURES.
J.Heicklen and W.A.Noyes, Jr.
J. Amer. Chem. Soc., Vol. 81, No. 15, 3858-63 (Aug. 5, 1959).

The photolysis of acetone vapour has been redone at 3130 A to very low conversions and the fluorescence and photolysis of acetone –biacetyl mixtures have been studied. If biacetyl is present during the photolysis of acetone at 3130 A, an energy transfer occurs between excited acetone molcules and biacetyl; the acetone photodecomposition and phosphorescence are diminished, and biacetyl phosphorescence is observed. Since biacetyl is a reaction product of acetone photolysis, the quantum yield of acetone decomposition decreases as the time of irradiation increases. The ratios of reaction products also change with time of irradiation. A detailed mechanism is presented for the primary process in acetone and for the energy transfer between acetone and biacetyl.

535.37 : 535.242.41

12113. AN APPARATUS FOR THE DETAILED STUDY OF PHOSPHORESCENCE DECAY CURVES OF MORE THAN 0.1 SEC DURATION. V.A.Pilipovich and B.Ya.Sveshnikov.
Optika i Spektrosk., Vol. 4, No. 1, 116-18 (Jan., 1958). In Russian. English summary: PB 141047T-3, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Describes an apparatus working over a brightness range of 10^7 and a time range of 0.1 sec to several minutes, giving accurately calibrated time intervals, and recording directly on to cine film. Sensitivity is varied during a run by the rapid (0.03 sec) insertion of graded neutral filters before the photomultiplier sensing element. Zero drift is < 1% in 30 min. The apparatus was used to study organic phosphors and a record of the decay curve for fluorescein in boric acid is shown. C.H.L.Goodman

535.37

12114. A METHOD OF MEASUREMENT FOR INVESTIGATING FLUORESCENCE DECAY PROCESSES. H.Schütz.
Z. Phys., Vol. 156, No. 1, 27-37 (1959). In German.

An electron beam falls on the phosphor after deflection in two directions at right angles at 1 and 11 Mc/s respectively and acceleration to 60 kV. The fluorescence falls on a photocathode from which the freed electrons are focused and deflected by the former frequencies with suitable time delays. Measurements are made by a photomultiplier and counter circuit. With the beams restricted by slits, a point by point determination of rise and decay curves can be made with a time discrimination of about 10^{-9} sec. Curves are shown up to 200×10^{-9} sec for pure solid anthracene and naphthalene and mixtures of polyacenes. The decays can be analysed into 1 or 2 exponentials. S.T.Henderson

535.37

12115. PHOSPHORESCENCE AND THERMAL DE-EXCITATION OF KBr:In PHOSPHORS. M.L.Kats.
Optika i Spektrosk., Vol. 6, No. 2, 237 (Feb., 1959). In Russian.

If KBr:In is excited with light from a mercury arc, which is not separated out spectrally, then comparatively intense phosphorescence is observed whose decay suggests the recombinational nature of the emission. Thermal de-excitation of these phosphors irradiated with X-rays suggests the same mechanism. The thermal de-excitation curve consists of two peaks. Optical measurements of changes in the absorption spectrum in the process of heating show that the high-temperature peak of the thermal de-excitation curve is due to electrons localized at F-centres. The author also found that the thermal de-excitation (thermoluminescence) curves of KBr:In phosphors were identical with the fluorescence spectra, suggesting that in both cases emission is due to similar electron transitions at similar centres. A.Tybulewicz

535.37

12116. THE EFFECT OF ENERGETIC RADIATION ON PHOSPHOR
W.Hanle.
Semiconductors and phosphors (see Abstr. 9597 of 1959) pp. 139-57 In German.

A review is given of the mechanisms of excitation, dependence of efficiency, decay time, trapping states etc. on the nature of the ionizing radiation. The radiation damage in phosphors, organic and inorganic, is also discussed and mention made of the use of phosphors as dosimeters. G.F.J.Garlick

535.37

12117. ON THE CATHODOTHERMOLUMINESCENCE EFFECT.
H.Gobrecht, D.Hahn and K.Scheffler.
Semiconductors and phosphors (see Abstr. 9597 of 1959) pp. 538-43 In German.

The temperature dependence of cathodoluminescence in many phosphors shows a maximum corresponding to the normal thermal glow maximum for warming conditions which disappears if measurements are made during cooling. An explanation is given in terms of electron traps coupled to activator centres. G.F.J.Garlick

535.37

12118. ELECTRON BOMBARDMENT OF SOLID ACETONE.
E.M.Hörl.
J. chem. Phys., Vol. 31, No. 2, 564-5 (Aug., 1959).

The glow emitted by condensed acetone vapour during electron bombardment has been studied and a spectrum taken. The afterglow and warm-up glow are also described and a general interpretation attempted. G.I.W.Llewelyn

535.37

12119. ELECTRICAL DISCHARGE INDUCED LUMINESCENCE OF SOLIDS AT LOW TEMPERATURES. L.J.Schoen and R.E.Rebbert.
J. molecular Spectrosc., Vol. 3, No. 4, 417-24 (Aug., 1959).

Luminescence of condensed nitrogen–oxygen–argon systems a low temperatures has been excited by a.c. and d.c. discharge techniques. Typical atomic and molecular spectra obtained by these methods are described. The structure and wavelengths of the β-line group attributed to trapped oxygen atoms ($^1S \rightarrow {}^1D$) and the wavelengths of the A and Vegard–Kaplan band systems are compared in nitrogen and argon matrices. In argon a line group interpreted as t $^1S \rightarrow {}^3P$ atomic oxygen transition has been observed. The principal mechanism of excitation under the conditions employed appears to be ion-electron bombardment of the deposited solid.

535.37

12120. LIGHT EMISSION FROM SOLID NITROGEN DURING AND AFTER ELECTRON BOMBARDMENT. E.M.Hörl.
J. molecular Spectrosc., Vol. 3, No. 4, 425-49 (Aug., 1959).

Nitrogen gas was condensed on a target at 4°K and bombarded with electrons of medium energy (3 to 50 kV). Emission spectra were obtained in the ultraviolet (2200-4000 A), visible (4000-7000 A) and near infrared (7000-8800 A) spectral regions. The change of these spectra as a function of the intensity of the bombarding electrons was investigated and the influence of impurities of oxygen and argon was studied. Half-life measurements were made of the intense lines and bands. The results obtained by the bombardment technique are compared with those obtained recently by the discharg method.

535.37 : 539.1.07

12121. THE DEPENDENCE OF THE DECAY PERIOD OF ORGANI SCINTILLATORS ON THE INTENSITY OF EXCITATION, AND THE APPLICATION TO THE DISCRIMINATION OF FAST NEUTRONS IN A BACKGROUND OF γ-RAYS. M. Forte.
Nuovo Cimento Suppl., Vol. 9, No. 2, 390-7 (1958). In Italian.

A study is made of the mechanisms involved in the emission of light organic scintillators as a function of the nature of the exciting particles and the shape and duration of the resultant pulses. In the

case of crystalline and plastic scintillators the existence of relatively long-lived component pulses is demonstrated, and results are presented for a number of scintillators. It is suggested that the methods of the study be extended to the discrimination of given species of particles from intense bachgrounds of γ-radiation.
S.J.St-Lorant

535.37

12122. ON THE CAUSES OF THE DEPENDENCE OF THE LUMINESCENCE YIELD OF ORGANIC SUBSTANCES ON THE ENERGY OF IONIZING PARTICLES. M.D.Galanin.
Optika i Spektrosk., Vol. 4, No. 6, 758-62 (June, 1958). In Russian. English summary: PB 141047T-11, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The origin of the quenching factor B in the Birks' relation $L' = AE'/(1 + BE')$, relating the specific fluorescence L' of an organic scintillator to the specific energy loss E', is discussed. It is shown that the high "thermal flash" in the initial excitation channel may cause a strong quenching of excited molecules produced by the primary particle. The general discussion is tested by calculation for anthracene excited by 5.3 MeV α-particles, and it is found that the theoretical temperature quenching is stronger than that observed experimentally. It is proposed that at high E' secondary electrons, whose paths go beyond the limits of the quenching zone, are important in the excitation of luminescence, although the main excitation channel may be completely quenched. J.B.Birks

535.37

12123. ON THE LAW OF DE-EXCITATION OF POLYSTYRENE EXCITED BY ELECTRONS. S.F.Kilin and I.M.Rozman.
Optika i Spektrosk., Vol. 6, No. 1, 65-9 (Jan., 1959). In Russian.

Using a modulated 30 kV electron beam and a phase fluorometer it was found that luminescence emission of polystyrene excited with electrons obeys a non-exponential law of decay. The experimental results agree satisfactorily with an assumption of bimolecular mechanism of quenching. The authors point out that the experimental data do not contradict a different assumption, i.e. that there are several components of fluorescence in polystyrene which decay exponentially with different constants τ. A.Tybulewicz

535.37

12124. THE EFFECT OF REABSORPTION ON THE DURATION OF FLUORESCENCE OF ORGANIC SUBSTANCES.
S.F.Kilin and I.M.Rozman.
Optika i Spektrosk., Vol. 6, No. 1, 70-7 (Jan., 1959). In Russian.

The authors studied the effect of reabsorption on the rate of decay of fluorescence of tetraphenylbutadiene and triphenylpyrazoline in polystyrene. It was found that within the experimental error the mean duration of fluorescence excited by electrons does not depend on frequency of emission, i.e. the decay law is an exponential one in the presence of considerable reabsorption. The mean duration of emission was found to increase with the concentration of the luminescing substances. The fluorescence spectra and the quantum yield agree with the calculations. A.Tybulewicz

535.37 : 621.383.2.032.3

12125. ELECTROLUMINESCENCE OF SULPHIDE PHOSPHORS IN SUSPENSION. H.A.Klasens.
Semiconductors and phosphors (see Abstr. 9597 of 1959) pp. 247-62. In German.

The mechanism of electroluminescence in ZnS:Cu is discussed in terms of a barrier layer of Cu_2S providing electrons to the conduction band under the applied field, with light emission from the delayed recombination of these electrons with holes at the activator levels. A secondary light pulse arises from trapped electrons freed on change of field direction. Experimental results supporting the theory include the form of the light waves, voltage, frequency and temperature effects. Some attention is given to the effects seen with a Mn activator. S.T.Henderson

535.37

12126. ELECTROLUMINESCENT PHENOMENA OBSERVED ON APPLICATION AND REMOVAL OF AN ELECTRIC FIELD.
A.M.Bonch-Bruevich.
Optika i Spektrosk., Vol. 6, No. 2, 256-7 (Feb., 1959). In Russian.

Flashes of electroluminescence, produced by application and removal (switching on and off) of an electric field, were studied. The electroluminescent cell was in the form of a plane capacitor of 0.01 mm thickness, filled with ZnS:Cu,Al phosphor in cable oil. Luminescence flashes on application of the field were found to depend strongly on the state of the phosphor, e.g., immediately after irradiation with red light no flash was observed. If two consecutive applications of the field were of opposite polarity the second application produced a flash irrespective of whether the phosphor was previously irradiated with red light or not. The removal of the field was accompanied by an electroluminescent flash irrespective of previous irradiation of the phosphor. These and other observed phenomena are explained by formation of ionized emission centres and subsequent electron–hole recombination. A.Tybulewicz

535.37

12127. BIMOLECULAR ELECTROLUMINESCENT TRANSITIONS IN GaP. E.E.Loebner and E.W.Poor, Jr.
Phys. Rev. Letters, Vol. 3, No. 1, 23-5 (July 1, 1959).

Bimolecular recombination is deduced from the nearly square dependence of the emitted radiation on the injection current. Direct observations of bimolecular band-to-band transitions at rectifying junctions in single crystals of gallium phosphide and indium phosphide are described. J.B.Birks

535.37'

12128. THERMOLUMINESCENCE AND SHALLOW TRAPS IN ZnS:Cu:Co. B.Goldstein and J.J.Dropkin.
J. Electrochem. Soc., Vol. 106, No. 8, 682-5 (Aug., 1959).

Trapping states of the hexagonal ZnS:Cu 10^{-4}: Co 10^{-6} phosphor were investigated by thermoluminescence as functions of the time and temperature of u.v. excitation and of the time and temperature of spontaneous or i.r. induced decay. The main copper (chloride) and cobalt peaks are complex, and retrapping takes place in both.

535.39

12129. VARIATIONS OF THE OPTICAL PROPERTIES OF A THIN LAYER OF SILVER AS A FUNCTION OF WAVELENGTH. R.Philip.
C.R. Acad. Sci. (Paris), Vol. 248, No. 24, 3418-20 (June 15, 1959). In French.

The transmission, reflection and absorption at the silver–air and silver–substrate (quartz) interfaces were measured between 2400 A and 6500 A. B.T.M.Willis

535.39

12130. MEASUREMENT OF THE OPTICAL CONSTANTS OF SILVER IN THE INFRARED SPECTRAL REGION.
I.N.Shklyarevskii, N.G.Starunov and V.G.Padalka.
Optika i Spektrosk., Vol. 4, No. 6, 792-5 (June, 1958). In Russian. English summary: PB 141041T-11, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The refractive index and absorption coefficient were measured in the 1-12 μ region by determining the phase difference of polarized radiation after multiple reflections from two parallel plates. The authors used two methods. Firstly the phase difference was made equal to -180°; and secondly, elliptically polarized radiation was circularly polarized by the plate and detected using a rotating analyser. D.L.Greenaway

535.39

12131. CERTAIN OPTICAL PROPERTIES OF CORUNDUM.
L.D.Kislovskii.
Optika i Spektrosk., Vol. 4, No. 1, 100-2 (Jan., 1958). In Russian. English summary: PB 141047T-3, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Transmission, reflection and dispersion in corundum, in the spectral region 0.075-35.0 μ, were calculated using a number of known experimental values for these properties. An equation is given for the dependence of refractive index on wavelength in the region 0.2-6.0 μ. The calculated reflection and transmission spectra and the dispersion dependence are in good agreement with experimental data. Z.Krasucki

535.39 : 537.226.2

OPTICAL PROPERTIES OF $Na(K\text{-}NH_4)$-TARTRATE MIXED CRYSTALS. See Abstr. 10949

535.39 : 537.311.33

OPTICAL PROPERTIES OF TIN OXIDE FILMS. See Abstr. 11026

535.39 : 539.2

12132. DETERMINATION OF THE FORBIDDEN BAND WIDTH FROM DIFFUSE REFLECTION SPECTRA. I.P.Shapiro.
Optika i Spektrosk., Vol. 4, No. 2, 256-60 (Feb., 1958). In Russian.

English summary: PB 141047T-1, obtainable from Office of Technical Services, U.S. Dept., of Commerce, Washington, D.C., U.S.A.

The forbidden bandwidth was obtained for a number of semiconductors and insulators by diffuse reflectance measurements on powdered samples. Results are given for: Cu_2O, CuO, Pb_2O, $CuCl_2$, Sb_2S_3, $SnCl_2$, ZnO, CdS, ZnS, CdI_2, PbI_2, and Se. D.L.Greenaway

535.39

12133. REFLECTION SPECTRA OF CRYSTALLINE QUARTZ PLATES, CUT AT VARIOUS ANGLES WITH RESPECT TO THE OPTICAL AXIS, IN THE 7-24 μ WAVELENGTH REGION.
N.A.Sevchenko and V.A.Florinskaya.
Optika i Spektrosk., Vol. 4, No. 2, 261-4 (Feb., 1958). In Russian.
English summary: PB 141047T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

535.39

12134. ON NON-VALIDITY OF THE KRAMERS–KRONIG DISPERSION RELATIONSHIPS IN THE CASE OF MOLECULAR CRYSTALS AT VARIOUS TEMPERATURES.
M.S.Brodin, A.F.Prikhot'ko and M.S.Soskin.
Optika i Spektrosk., Vol. 6, No. 1, 28-32 (Jan., 1959). In Russian.

The paper analyses the published data on absorption and dispersion of light in monocrystals of anthracene, stilbene and tolane, and the authors' own results on 1,2-benzanthracene. It is found that the Kramers–Kronig dispersion relationships are not obeyed; the departures from these relationships are greatest at low temperatures (20°K) and they decrease with increase of temperature. A.Tybulewicz

535.39

12135. SOME EFFECTS OF STRAIN IN THIN SPECIMENS ON ABSORPTION MEASUREMENTS AT LOW TEMPERATURE.
G.G.Macfarlane, T.P.McLean, J.E.Quarrington and V.Roberts.
Phys. Rev. Letters, Vol. 2, No. 6, 252-4 (March 15, 1959).

Experiments to resolve a two-fold discrepancy in measurements of absorption in thin polished plates of Ge, in the range from room temperature to 1.5°K are described. The results are interpreted in terms of strains set up in the specimens at the lower range of temperature as a result of mounting the specimens on a rigid backing. G.C.Williams

535.392

12136. REFLECTIVITY SPECTRUM AND OPTICAL CONSTANTS OF BITUMINOUS COAL; ESTIMATION OF AROMATICITY.
R.A.Friedel.
Science, Vol. 130, 220-1 (July 24, 1959).

The spectra of reflectivities, refractive indices, and absorption indices of a bituminous coal vitrain have been determined for the ultraviolet–visible region. The low values for these quantities support the premise that polynuclear condensed aromatics may be present in coal only in small amounts. Aliphatic and amorphous carbons may predominate.

535.393

12137. APPLICATION OF KRAVETS' METHOD FOR THE DETERMINATION OF THE OPTICAL CONSTANTS OF METALS.
G.P.Skornyakov and M.M.Kirillova.
Optika i Spektrosk., Vol. 6, No. 2, 248-9 (Feb., 1959). In Russian.

Kravets et al. (1948) described a method of measuring optical constants using specular reflection of normally incident light, with the substance deposited in the form of a wedge on a transparent base. The present paper describes an application of Kravets' method to the determination of the optical constants of metals. A polished metal sample was immersed in a bath filled with a liquid. The sample was placed in such a way that the layer of liquid above it was wedge-shaped. Reflection was measured in two different liquids at angles close to the angle of normal incidence. The liquids used were methyl alcohol, benzene and toluene. Using this technique the authors measured the refractive and absorption indices of nickel cobalt, silver and aluminium (the latter in the form of a film). The error in the final values of the optical constants did not exceed 9%. The values obtained agreed with those published earlier. This method may also be used in the ultraviolet and infrared spectral regions. A.Tybulewicz

535.393

12138. PREPARATION OF TRANSLUCENT FILMS WHICH ARE TRANSPARENT IN THE INFRARED SPECTRAL REGION.
Z.V.Shirokshina and N.V.Sulkovskaya.
Optika i Spektrosk., Vol. 4, No. 1, 82-6 (Jan., 1958). In Russian.
English summary: PB 141047T-3, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Films (≅ 1 μ thick) of the oxides of antimony, germanium, silicon, tin and titanium, were prepared by deposition of organic salts and inorganic chlorides on suitable substrates. Subsequent hydrolysis and solvent evaporation leaves an oxide film which is durable and uniform. The films posess good transparency in the 3-15 μ region and exhibit the usual blooming effect when the film thickness = $\pi/4$. D.L.Greenawa

535.393

12139. DETERMINATION OF THE WEAK ABSORPTION IN THIN DIELECTRIC FILMS. G.Koppelmann and K.Krebs.
Z. Phys., Vol. 156, No. 1, 38-54 (1959). In German.

Highly accurate measurements were made and the coefficients of absorption evaluated. Results are stated for such substances as cryolite, MgF_2, NaF, paraffin, ZnS and Sb_2O_3.

535.41

12140. THE INTERFERENCE OF TWO BEAMS OF LIGHT PASSING THROUGH OPPOSITELY ROTATING [OPTICALLY ACTIVE] MEDIA. M.Zavetova.
Czech J. Phys., Vol. 8, No. 2, 229-32 (1958). In Russian.

The purpose of the experiment was to verify Vavilov's assertio Monochromatized light, after passing through a circular diaphragm fell perpendicularly on two circular openings. The interference pattern was photographed in the focal plane of a telescope. A numb of optically flat quartz plates, cut perpendicular to the optical axis, were placed in front of the openings, the thickness of the individual plates being chosen so that each rotated the plane of polarization by (180 – 15)°. On the central area of the diffraction pattern, which was produced by diffraction on one circular opening, a system of parallel light and dark fringes was distributed, the contrast in whic decreased on increasing the number of plates with opposite directions of rotation. When the mutual rotation was equal to 90° the parallel lines disappeared. The result of the experiment can be interpreted on the basis of the classical theory of interference.

535.41

12141. INTERFERENCE FRINGES OF EQUAL THICKNESS IN TH CASE OF LARGE WEDGE ANGLE AND LARGE APERTURE.
G.Schulz.
Optik, Vol. 16, No. 5, 280-7 (May, 1959). In German.

An analysis of the effects of large angle thickness and large aperture shows that the relation between fringe spacing and thickne can depart by as much as 10% when such angles and apertures are large. With a variable wedge angle due to a topography, it is diffi- cult to specify the correction. A condition is derived in which the correction can be made to vanish. Thickness is established in ter of order of interference, wedge angle and aperture. S.Tolansk

535.41

12142. FOURIER EXPANSIONS FOR THE INTERFERENCE FILM. Z.Knittl.
Czech. J. Phys., Vol. 8, No. 3, 285-95 (1958).

The energy transmission and reflection of a single dielectric film are expressed as Fourier series which have only a finite num ber of terms corresponding to the number of interfering beams co sidered. Some known general theorems are derived. W.T.Welfo

535.4

12143. SIMPLE PHOTOELECTRIC SETTING METHOD FOR INTI FEROMETRIC MEASUREMENTS. P.Hariharan and D.Sen.
J. Opt. Soc. Amer., Vol. 49, No. 9, 930-1 (Sept., 1959).

A simple chopped-beam device described enables fractional orders in a two-beam interferometer to be found to $\lambda/300$. E.A.Muss

535.4

12144. ON THE POSSIBILITY OF OBSERVING INTERFERENCE EFFECTS WITH LIGHT BEAMS DIVIDED BY A SHUTTER.
L.Mandel.
J. Opt. Soc. Amer., Vol. 49, No. 9, 931-3 (Sept., 1959).

It is shown that in the hypothetical experiment, referred to by Janossy and Nagy (Abstr. 4179 of 1956), in which a light beam is divided into two beams by a random shutter in such a way that the two paths are never open simultaneously, interference fringes wil

observed provided that the mean time T between shutter switchings not appreciably greater than the coherence time of light. Curves, mputed for a given spectral line, show how the visibility increases T decreases. E.A.Mussett

535.417

2145. INTERFERENCE MIRRORS ON AN ALUMINIUM BASE. .I.Tarasov.
ptika i Spektrosk., Vol. 6, No. 1, 94-6 (Jan., 1959). In Russian.
The coefficients of reflection R, transmission T and absorption of the Fabry–Perot interferometer mirrors determine completely its spectral properties: R determines its resolving power nd A/T determines the intensity of its interference rings. The uthor's intention was to obtain mirrors with the smallest possible atio A/T with sufficiently high values of R in the region 3200-5600 A. variance of the ratio A/T on deposition of non-absorbing layers on etals makes it possible to use a thin aluminium layer as a base t has a low value of A/T) and to raise the value of R by deposition several layers of SiO_2 and TiO_2 on aluminium. Best results were btained by deposition of two layers, first SiO_2 and then TiO_2 on uminium mirrors. A.Tybulewicz

535.417

2146. PHASE CHANGES ON REFLECTION FROM EVAPORATED HROMIUM FILMS. C.Weaver, R.M.Hill and J.E.S.Macleod.
Opt. Soc. Amer., Vol. 49, No. 10, 992-7 (Oct., 1959).
Measurements were made by multiple beam interference ethods using Fizeau fringes and fringes of equal chromatic order obtain the variation of phase change on reflection as a function of lm thickness for chromium films deposited by evaporation on lass substrates. The results do not agree closely with theoretical urves but this was shown to be due to the inhomogeneity of the hromium films and the deviations from theory were explained in erms of a structural model based on independent evidence. The xperimental curve was used to explain anomalies which were reported previously in measurements of the thickness of silver films by ultiple beam interference methods when chromium is used as the eflecting overlayer.

535.42

2147. HOW DARK IS THE SHADOW OF A ROUND-ENDED CREEN? J.B.Keller.
appl. Phys., Vol. 30, No. 9, 1452-4 (Sept., 1959).
Two kinds of screens are considered, (1) having thickness 2b nd edge of semicircular cross-section of radius b and (2) of egligible thickness with an edge formed by cylindrical beading of adius b. The distant diffracted field in a direction at 45^0 inside the hadow is calculated according to the geometrical theory of diffraction for both polarizations as a function of $2\pi b/\lambda$. For screen (2) e results of an exact calculation based on Maxwell's equations are ven; these show good agreement with results from the geometrical eory for $2\pi b/\lambda \geq 4$. W.T.Welford

535.42 : 578.087

VOLUME AND INDEX MEASUREMENTS OF BLOOD CELLS TH A RECORDING DIFFRACTOMETER. See Abstr. 11672

535.421

2148. THE INFLUENCE OF THE CURVATURE AND MATERIAL F AN EDGE ON THE DIFFRACTION OF LIGHT. I. W.Hartnagel.
nn. Phys. (Leipzig), Folge 7, Vol. 4, No. 15, 188-202 (1959).
German.
The absolute intensity and the phase difference and amplitude atio between the two polarizations of a plane wave diffracted by an dge were measured. The curvature of the edge cross-section and ne optical constants of the material (steel) were also measured. W.T.Welford

535.421

2149. DIFFRACTION BY A SLIT. R.Plonsey and Hwei-Piao Hsu.
appl. Phys., Vol. 30, No. 9, 1468 (Sept., 1959).
An investigation and criticism of a technique by Hadlock Abstr. 477 of 1959) for the calculation of the aperture field in a lit when a plane electromagnetic wave is normally incident.

535.421

2150. ON THE INFLUENCE OF THE FORM OF THE RULINGS F A PLANE PHASE GRATING ON THE LIGHT DISTRIBUTION IN HE FRAUNHOFER DIFFRACTION PATTERN. O.Schaffer.
ptik, Vol. 16, No. 4, 200-33 (April, 1959). In German.
The Fraunhofer diffraction pattern of a single grating element is calculated, taking account of refraction and polarization effects due to the ruling profile and the pattern for the whole grating is obtained by summation. Some special cases of trapezoidal ruling profiles are treated in detail. The profile of a glass grating of 10μ spacing was determined interferometrically and the observed distribution of light among the different orders was compared with that predicted by the formulae, taking a trapezoidal shape as an approximation to the observed ruling profile. W.T.Welford

535.421 : 535.33.07

THEORY OF CONCAVE GRATING. SEYA–NAMIOKA MONOCHROMATOR. See Abstr. 11993

535.43

12151. ON THE REDUCTION OF SCATTERED LIGHT IN IMAGING SYSTEMS. F.-L.Deubner.
Z. Astrophys., Vol. 48, No. 1, 34-8 (1959). In German.
Calculations and experimental results are presented to show that non-image-forming elements, e.g. filters, plane mirrors and polarizers, should be placed as far from real image positions as possible in order to reduce the effects of scattered light. W.T.Welford

535.51

12152. HALF-SHADE DEVICE FOR THE PRECISE MEASUREMENT OF THE PRINCIPAL ANGLE OF INCIDENCE. K.Kinosita and S.Nomura.
J. Phys. Soc. Japan, Vol. 13, No. 12, 1485-96 (Dec., 1958).
Pfund's half-shade analyser, which originally was devised for the measurement of the Brewsterian angle, ϕ_B, can be applied to the measurement of the principal angle of incidence, ϕ_P. Its sensitivity, h, and possible sources of systematic errors are discussed. It is shown that, in the measurement of ϕ_B, h can be made to approach ∞, but in the measurement of ϕ_p, h is finite and sometimes very small. A superior half-shade device for the precise determination of ϕ_p is proposed, which consists of a $\lambda/4$-plate, a half-shade plate of the type of Bravais bi-plate, and an analyser (polarizing plate). Its sensitivity is discussed and the systematic errors are analysed.

535.52

12153. INVARIANT METHODS IN THE OPTICS OF TRANSPARENT NON-MAGNETIC CRYSTALS. F.I.Fedorov.
Kristallografiya, Vol. 3, No. 1, 49-56 (1958). In Russian.
An invariant method, which avoids the use of a special system of principal axes, is applied to uni-axial and bi-axial crystals, with a view to simplifying the discussion of the surfaces representing geometrically the optical behaviour of the crystals. See also Abstr. 9122-4 of 1957, 932-3 of 1958. R.F.S.Hearmon

535.542.1

12154. INTERPRETATION OF STANDARDIZATION CURVES OF EHRINGHAUS-(QUARTZ-) COMPENSATORS. R.Rath.
Abhandl. Braunschw. Wiss. Gesell., Vol. 10, 9-24 (1958). In German.
The curves found during gauging of quartz compensators are explained as combinations of errors in observation, thickness and parallelism. Optical activity is not significant. Computations are made of the effects of errors in the thickness of the plates and the effects of wedge errors in parallelism for incidence from 10^0 to 70^0. S.Tolansky

535.557

12155. ON THE UTILIZATION OF THE TIME LAG IN THE THERMAL DISTURBANCE EFFECT FOR THE MEASUREMENT OF STREAMING BIREFRINGENCE. H.Janeschitz-Kriegl.
Physica, Vol. 24, No. 11, 913-19 (Nov., 1958). In German.
With a rotating concentric cylinder apparatus a sheared liquid suffers an appreciable temperature rise with a temperature gradient from the centre of the annular gap to either of the cylinder walls. Calculations have shown that no decisive improvement can be made by using cylinders of low thermal conductivity instead of metal cylinders. R.Schnurmann

535.56 : 538.613 : 537.311.33

12156. FARADAY EFFECT OF THE MOTT EXCITON. A.G.Samoilovich and L.L.Korenblit.
Dokl. Akad. Nauk SSSR, Vol. 123, No. 5, 828-31 (Dec. 11, 1958).
In Russian.
It is shown that a hole-electron pair contributes to the Faraday

effect, by an amount which is proportional to the difference between the two effective masses. The argument assumes an exciton size less than the optical wavelength. An exciton concentration of 10^{18} cm^{-3} can give a Faraday effect having the normal order of magnitude for crystalline media. I.D.C.Gurney

535.56 : 538.27

12157. EFFECT OF ELECTRON PARAMAGNETIC RESONANCE ON THE OPTICAL FARADAY EFFECT AT LOW TEMPERATURES.
G.V.Skrotskii, P.S.Zȳryanov and T.G.Izyumov.
Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1471-4 (1958).
In Russian.

An expression has been found for the angle of rotation of the polarization plane of a light wave in a sample located in a constant and radiofrequency magnetic fields in the neighbourhood of paramagnetic resonance. A comparison is made with experimental data.

535.565

12158. OPTICALLY ACTIVE FLUORITE FILMS.
N.O.Young and J.Kowal.
Nature (London), Vol. 183, 104-5 (Jan. 10, 1959).

Optically active films of a normally isotropic material can be made by oblique evaporation on to a substrate revolving about its normal as an axis. Fluorite films up to 18 μ thick were made in this way and their optical activity measured. The maximum rotation of the plane of polarization of a normally incident beam was 155° per mm, and the mean birefringence was 19%. C.Hilsum

535.65

12159. CALCULATION OF SMALL COLOR DIFFERENCES.
F.L.Wurzburg, Jr, A.DiBernardo and J.R.Cleary.
J. Opt. Soc. Amer., Vol. 49, No. 10, 974-80 (Oct., 1959).

Photoelectric colorimeters can be used as differential instruments to determine the ratios of tristimulus values of similar colouring materials to a high degree of precision. In the past, the difficult and time-consuming methods of calculating colour coordinate differences from such data have seriously hindered their practical usefulness. It is shown that such calculations can be very greatly simplified for small colour differences by making use of an approximation that becomes increasingly better as the colour difference becomes smaller.

535.7

PHYSIOLOGICAL OPTICS. VISION. See also the Section entitled "BIOPHYSICS. PHYSIOLOGICAL PHYSICS".

535.8

12160. THE POSSIBILITY OF CORRECTING AN ERROR DUE TO COMPENSATING PRISMS. S.Guidarelli.
Atti Fond. Ronchi, Vol. 14, No. 3, 269-80 (May-June, 1959).
In Italian.

The compensating prism used in rangefinders etc. is often made from two equal and oppositely rotating thin refracting prisms. The deviation produced does not lie in a fixed plane and the paper deduces a formula for the variation of this plane with the prism position. Means of overcoming this defect are given. R.W.Fish

535.8 : 518.5

OPTICAL ANALOGUE COMPUTERS. See Abstr. 11710

535.81 : 621.396.96

12161. OPTICAL SIMULATION OF RADAR RESOLUTION.
R.D.Rawcliffe, W.W.Lichtenberger and H.V.Krone.
J. Opt. Soc. Amer., Vol. 49, No. 9, 877-90 (Sept., 1959).

It is difficult and expensive to evaluate with radar equipment the resolution required in order that a given target be detectable. In an effort to obtain this information more cheaply and easily, an optical simulator was constructed in which the very high resolution in an optical aerial photograph is degraded by known amounts. Portions of typical degraded photographs are included.

535.825

12162. A DESCRIPTION OF A MICRO-FILM APPARATUS FOR TIME-LAPSE PHOTOGRAPHY. G.Mai and U.Heine.
Z. wiss. Mikr., Vol. 64, No. 2, 64-72 (Jan., 1959). In German.

Constructional details are given of the time-lapse unit for attachment to a conventional microscope. The attachment allows automatic exposure at fixed time intervals. Sample photographs of cell growth are shown. R.W.Fish

535.8

12163. PULSED HIGH-TEMPERATURE SOURCE OF LIGHT.
A.A.Mak.
Dokl. Akad. Nauk SSSR, Vol. 123, No. 4, 671-2 (Dec., 1958).
In Russian.

Describes a study of the optical characteristics of a spark discharge occurring in a cavity surrounded by a wall of water, produced with the aid of a turbine. The length of the spark gap in the cavity was 10 mm, and the diameter of the capillary cavity vari from 0.4 to 1 mm. The brightness of the discharge channel was investigated by a photoelectric method previously described [Vanyukov, Mak, Parazinskaya: Optika i Spektrosk., Vol. 1, No. 5, 642-9 (1956); Abstr. 7061 of 1958]. It was found that, as the diameter of the cavity decreased from 1 to 0.4 mm, the brightness increased; it attained a maximum at ~ 0.5-0.8 mm diameter, after which it rapidly decreased. A graph shows the relationship betwee the momentary spectral density of the energetic brightness of the discharge channel and the wavelength (for the moment 0.2μ sec aft the beginning of discharge); a second graph shows the dependence c the maximum temperature of the discharge channel on the value of the initial condenser voltage (for the diameter of 0.5 mm). A maxi mum temperature of 6×10^4 °K was recorded. F.Lachma

HEAT

536.2.0

12164. EFFECT OF CARRIER GAS ON KATHAROMETER RESPONSE. W.A.Wiseman.
Nature (London), Vol. 183, 1321-2 (May 9, 1959).

It is pointed out that, while the conclusion that the response (at constant temperature) is inversely proportional to the square root of the thermal conductivity of the gas is borne out by the behaviours of H_2 and He, the agreement is purely fortuitous. The importance of heat loss by convection, by conduction down the lead etc. when considering carrier gases other than H_2 and He is stress W.Goc

536.

12165. MEASUREMENT OF THE THERMAL DIFFUSIVITY OF SOLIDS. L.Sicard, L.Eyraud, G.Malécot, J.Elston and C.Eyraud.
C.R. Acad. Sci. (Paris), Vol. 248, No. 21, 2970-2 (May 25, 1959).
In French.

The specimen is in the form of a parallelopiped and one of its faces is subjected to periodic thermal shocks. Thermocouples to measure the temperature variations are placed along the axis of symmetry of the specimen. The theory of the method is discussed critically with regard to the usual experimental arrangements and their applicability to high frequencies and temperatures.

S.Weintrou

536.2

12166. MEASUREMENT OF THERMAL CONDUCTIVITY BY UTILIZATION OF THE PELTIER EFFECT.
T.C.Harman, J.H.Cahn and M.J.Logan.
J. appl. Phys., Vol. 30, No. 9, 1351-9 (Sept., 1959).

The Peltier heat is used to maintain a temperature gradient along the specimen. Straightforward measurements allow calcula of the absolute value of the thermoelectric power, thermal conduc tivity, and electrical resistivity. An especially useful feature of t method is that the thermoelectric figure of merit is given in term of the ratio of two voltages. The theory is presented for the case which the radiative heat transfer is important. The method has b tested experimentally at 300° K only, but analysis suggests that accurate measurements of thermal conductivity can be made by th technique on low thermal conductivity materials of small dimensi up to 1000° K.

536.212 : 537.311.

12167. THERMAL CONDUCTIVITY OF InSb. H.Weiss.
Semiconductors and phosphors (see Abstr. 9597 of 1959) pp. 497-
In German.

Two single crystals, the one n-type with donor concentration 10^{17} cm^{-3} and the other p-type with an acceptor content of 3×10^{18} cm^{-3}, were measured. The vertical crystal was heated b furnace at the top of the crystal and the temperature gradient dow the crystal was measured by inserted thermocouples. Results for both the electrical conductivity, and the thermal conductivity λ, a

a function of 1/T are shown graphically. Both crystals have essentially the same λ. $\lambda G = 12/T$ in cal cm^{-1} sec^{-1} deg^{-1} K for the lattice conductivity, but λ_{el} for the electronic contribution at 700°K is about twice the theoretical value. It is reported that measurements on polycrystalline InAs with a donor content of 1.5×10^{11} cm^{-3} gave $\lambda G = 22/T$ for the range 20° to 300°C. S.Weintroub

536.212 : 537.311.32

12168. ANISOTROPIC THERMAL CONDUCTIVITY IN TELLURIUM SINGLE CRYSTALS.
Kh.I.Amirkhanov, G.B.Bagduev and M.A.Kazlaev.
Dokl. Akad. Nauk SSSR, Vol. 124, No. 3, 554-6 (Jan., 1959).
In Russian.

The crystals were prepared by slowly cooling tellurium from 750°K to room temperature in a quartz container. The variation of thermal conductivity with temperature was measured, and it was shown that at 100°K the coefficient of thermal conductivity $\lambda_{||}$ in a direction parallel to the cleavage plane is more than twice as great as $\lambda_{\perp}$, the coefficient of thermal conductivity perpendicular to the cleavage plane. At 500°K, $\lambda_{||}$ is ~ 1.5 times greater than $\lambda_{\perp}$. The variation of electrial conductivity with temperature was measured between 100° and 640°K and a marked discontinuity was observed at ~ 220°K. The results are compared with theory and reasonable agreement obtained. H.C.Cole

536.212 : 539.17

TEMPERATURE DISTRIBUTION IN UNSHEATHED CYLINDRICAL FUEL ELEMENTS. See Abstr. 11494

536.23

12169. THERMAL CONDUCTIVITY OF NITROGEN–CARBON MONOXIDE MIXTURES. R.S.Brokaw.
J. chem. Phys., Vol. 31, No. 2, 571-2 (Aug., 1959)

Observed values of thermal conductivity are plotted against N_2 concentration at temperatures between 273° and 1033°K and compared with theoretical estimates. The deviations from a linear mixture law arise from the same factors as cause anomalies in the diffusion coefficients (Abstr. 4351 of 1959). R.F.S.Hearmon

536.24 : 532.517.2

12170. ON THE QUESTION OF THE EQUIVALENT DIAMETER FOR HEAT TRANSFER IN SLITS HEATED ON ONE SIDE.
H.Hausen.
Abhandl. Braunschw. Wiss. Gesell., Vol. 10, 150-65 (1958).
In German.

The heat transfer in a fluid flowing between two parallel surfaces, one or both of which are cooled, is investigated theoretically. The temperature distribution over a cross-section is calculated and the result shows that the conditions for heat transfer are the same whether one or both surfaces are cooled. The mean temperature of the fluid is altered, however, and the heat transfer coefficient α, which is related to the difference between the mean temperature and the wall temperature, is smaller when only one surface is cooled. A relation for the dependence of the ratio of the α's on the Prandtl number is obtained and the effect of increasing Prandtl number is discussed. S.Weintroub

536.24

12171. THE EQUATION FOR THE COOLING OF A BODY IN THE STREAM OF A COMPRESSIBLE MEDIUM. V.Bartošek.
Czech. J. Phys., Vol. 8, No. 4, 440-2 (1958). In German.

The heat conduction equation of the problem is derived in order to argue the plausibility of the practice of using c_p rather than c_v in the constant in King's formula for the cooling of a hot wire (Cf.Burgers, Handbuch der Experimentalphysik. Edited by W.Wien and F.Harms. Vol. IV, Pt I. Leipzig: Academische Verlagsgesellschaft p. 640). W.A.Hepner

536.27 : 532.52

12172. THE MOVING FLAME EXPERIMENT. M.E.Stern.
Tellus, Vol. 11, No. 2, 175-9 (May, 1959).

When a flame is rotated around the outside bottom rim of a cylindrical pan of water initially at rest, Fultz (unpublished, 1956) has observed that the fluid acquires a net vertical component of angular momentum opposite to the rotation of the heat source. This experiment has been repeated in a cylindrical annulus in order to restrict the radial motions and it was found that the same phenomenon occurs. Using a simple model based on the latter experiment, the mechanism is investigated by which a fluid can acquire and maintain this momentum, considering that friction is the only force which can exert a net torque about the vertical. The effects of the heat source are replaced by a forced temperature field which has sinusoidal variations in the circumferential direction and which rotates about the vertical axis at a constant rate. The correlation between vertical and horizontal velocity components in the equilibrium state has been computed from the linearized two-dimensional vorticity equation. It is shown that when the viscosity is small or when the speed of the heat source is large there is a convergence of horizontal momentum towards the centre of the channel which is balanced by the viscous stress of the induced mean motion. The total momentum of the fluid is computed from the conservation principle and is found to vary inversely as the square root of the molecular viscosity and inversely as the 5/2 power of the speed of the heat source.

536.3 : 551.521.6

12173. BACKGROUND NOISE MEASUREMENTS AT THE SEA HORIZON. L.J.Free.
J. Opt. Soc. Amer., Vol. 49, No. 10, 1007-11 (Oct., 1959).

The design of passive infrared detection systems requires a knowledge of the sea-horizon background noise. The horizontal wave-number distribution of noise from the sky immediately above and the sea immediately below the horizon was measured during 1956 and 1957. The measurements, which are discussed in this paper, included the range of wave numbers from 7.1 to 91 cycles/rad. The results are graphed in terms of the one-dimensional angular Wiener spectrum of the background noise as a function of the horizontal wave number and show that both the sky and sea noise spectra are inversely proportional to the 1.7 power of the wave number in the region from 14 to 91 cycles/rad. A brief discussion of the analysing equipment is also included.

536.3

12174. THE EMISSIVITY OF CARBON AT THE SUBLIMINATION TEMPERATURE. F.Anacker and R.Mannkopff.
Z. Phys., Vol. 155, No. 1, 16-22 (1959). In German.

Emissivities are determined by comparison with the radiation from a cavity at the same temperature; the value increases from 0.74 at 4000 A to 0.77 at 6400 A. G.F.Lothian

536.413

12175. THERMAL EXPANSION COEFFICIENTS OF SINGLE CRYSTALS OF THE GUANIDINE–ALUMINIUM–SULPHATE–HEXAHYDRATE GROUP. S.Haussühl and F.Trost.
Z. Naturforsch., Vol. 14a, No. 4, 437 (April, 1959). In German.

Values obtained for the linear thermal expansion coefficients in the a and c directions for G–Al–S–H, G–Ga–S–H, G–Al–Se–H and G–Ga–Se–H crystals by means of the Schaeffer–Bergmann acoustic method, and by a Fizeau interferometric dilatometer, are tabulated and compared. The temperature range covered was 0-80°C. S.Weintroub

536.421 : 531.75

12176. A DILATOMETRIC STUDY OF GALLIUM AT ATMOSPHERIC PRESSURE. A.Defrain and I.Epelboin.
C.R. Acad. Sci. (Paris), Vol. 249, No. 1, 50-2 (July 6, 1959).
In French.

Thermal analysis and dilatometry confirm that Ga of 99.9% purity has an unstable solid phase, the melting point of which is -17 ± 1°C at atmospheric pressure. The experimental curves are shown. At −23°C stable, unstable and (supercooled) liquid Ga have densities of 5.92, 6.23 ± 0.01, and 6.135 ± 0.015 g/cm^3 respectively. S.Weintroub

536.422 : 532.612

SURFACE TENSION AND HEAT OF SUBLIMATION OF SILICON, GERMANIUM AND TIN. See Abstr. 11890

536.422/.423 : 532.529

12177. EVAPORATION INTO A BOUNDARY LAYER.
II. DISSOCIATION IN EVAPORATION. E.Bauer and M.Zlotnick.
Phys. of Fluids, Vol. 2, No. 2, 236-7 (March-April, 1959).

For Pt I see Abstr. 256 (1959). The theory of steady state evaporation of a solid or liquid material into a stream of gas flowing across the surface of the solid or liquid is extended to include simple chemical reactions which might occur at the boundary. G.I.W.Llewelyn

536.422.1

12178. VAPORIZATION OF SOLID BODIES [IN THE FORM OF] SPHERES [SUSPENDED] IN A STREAM OF GAS. V.I.Zubkov.
Dokl. Akad. Nauk SSSR, Vol. 123, No. 5, 803-6 (1958). In Russian.

Small spheres of naphthalene and of camphor were exposed to a stream of air flowing through a tube, and progress of vaporization was measured by weighing. By taking successive photographs of the solid particle the change of its shape was recorded. It was found that the rate of vaporization was largest in the wake and very nearly equal to the rate of vaporization at the front of the spheres. It appears that the rate at which the surface area decreases per unit time is independent of the size and shape of the spheres. A graph shows this rate as a function of the temperature of the flowing air. R.Eisenschitz

536.423

12179. THE HEAT OF EVAPORATION AND THE LAW OF CORRESPONDING CONDITIONS. A.V.Voronel'.
Zh. tekh. Fiz., Vol. 29, No. 3, 304-6 (March, 1959). In Russian.

The internal heat of evaporation of a fluid is related to the densities of the liquid and gaseous phases. With logarithmic scales, the relation is linear for all the fluids examined, except for oxygen. P.G.Morgan

536.424 : 538.27

12180. PHASE TRANSITIONS IN KIO_3 DETECTED BY N.Q.R. F.Herlach, H.Gränicher and D.Itschner.
Arch. Sci. (Geneva), Vol. 12, Special No., 182-4 (1959).

1959 Maxwell-Ampere Conference paper (see Abstr. 11542 of 1959). A study of the I^{127} resonance in the range 20° to 280° C and the structure by X-rays in the range 20° to 400° C. Quadrupole resonance shows two clear phase transitions at 75° C and 220° C which are only weak for X-rays. J.G.Powles

536.424.1

12181. MICROSCOPY AT LIQUID HELIUM TEMPERATURES: PHASE TRANSITION IN SODIUM. D.Hull and H.M.Rosenberg.
Phys. Rev. Letters, Vol. 2, No. 5, 205-6 (March 1, 1959).

The percentage of Na which had transformed to the hexagonal phase at 6° K was estimated by microscopic examination at that temperature. It was found to be about 45%, a figure much higher than that of 5% derived from Barrett's X-ray data [J. Inst. Metals, Vol. 84, Pt 2, 43 (1955), and Abstr. 792 of 1957], but one which is consistent with observations made of specific heat (Abstr. 5841 of 1958) and electrical resistance (Abstr. 2310 of 1959). The authors' unpublished work on tensile tests is also consistent with the higher figure. J.Thewlis

536.45 : 537.525.4

12182. DETERMINATION OF THE TEMPERATURE OF A SPARK IN VACUUM. E.M.Akimov and I.P.Malkov.
Optika i Spektrosk., Vol. 6, No. 1, 96-8 (Jan., 1959). In Russian.

This was determined from the relative intensities of lines in the spectrum of Al III. Two pairs of lines were used: 1862.90 A ($3S_{1/2}$-$3P_{1/2}$) and 1605.7 A ($3P_{1\,a/2}3D_{3/2}$), 1854.67 A ($3S_{1/2}$-$3P_{3/2}$) and 1605.7 A ($3P_{1/2}$-$3D_{3/2}$), The following values were obtained: 45000° K from the lines 1862 and 1605 A, and 47000° K from the lines 1854 and 1605 A. These values are interpreted as the temperature of the Al III ions at the moment of excitation. A.Tybulewicz

536.48

12183. ON SOLUTIONS OF He^3 AND He^4.
S.K.Trikha and V.S.Nanda.
Progr. theor. Phys., Vol. 17, No. 5, 679-710 (May, 1957).

A theory of He^3 and He^4 solutions has been developed on the basis of the following assumptions: (i) He^3 mixes with the whole of He^4 (normal as well as superfluid); (ii) the contribution to the entropy of mixing is due only to the normal part of He^4; and (iii) the solution of He^3 in He^4 is not an "ideal solution" even above the λ-temperature. It obeys laws of a "strictly regular solution". Agreement between theory and experiment concerning the λ-temperature of the solution, molar specific heat of mixing, vapour pressure in solution, the distribution coefficient and the measurements of vapour pressures at dew points is found to be satisfactory.

536.48

12184. THEORY OF BOSE–EINSTEIN FLUIDS, STATISTICAL MECHANICAL TREATMENT OF THE THERMODYNAMIC PROPERTIES OF LIQUID HELIUM. S.Baldursson, J.E.Mayer and H.Aroeste.
J. chem. Phys., Vol. 31, No. 3, 814-29 (Sept., 1959).

A formal development of the difference in thermodynamic properties of a Bose–Einstein and a hypothetical Boltzmann system is presented. The treatment is valid for any thermodynamic phase of the two systems, including the liquid phase to which it is intended to apply. The formal equations show the change in activity of the liquid–gas and crystal–liquid transitions for the two systems. A transition, identified with the lambda transition in liquid helium, is predicted. By reasonable choice of a reduced mass parameter the lambda line can be correctly located. The nature of the lambda transition is related to the behaviour at its singularity, of a series the n-th coefficient of which is a defined integral of functions of coordinates of n molecules. The simplest assumption which can be made to permit integration does not lead to the correct order of the transition.

536.48 : 534.

12185. THE VELOCITY OF SOUND IN LIQUID HELIUM NEAR THE λ POINT. C.E.Chase.
Phys. Rev. Letters, Vol. 2, No. 5, 197-9 (March 1, 1959).

The high attenuation, and consequent dispersion, near the λ-point make it difficult to measure the low-frequency sound velocity u_0 in this region. A method is described for evaluating u_0 from known thermodynamic functions, using Pippard's "cylindrical approximation" (Abstr. 7367 of 1956). Agreement with experiment is good below the λ-point, but less good above it. The theory predicts a sharp drop of about 1.5 m/sec in u_0 within 10^{-4} ° K of T_λ, arising from the behaviour of C_p. R.G.Chambe

536.

12186. HYDRODYNAMICS OF LIQUID HELIUM II. C.C.Lin.
Phys. Rev. Letters, Vol. 2, No. 6, 345-6 (March 15, 1959).

Without presenting any deductions the author reports on the principles and results of a new theory. Helium is regarded as a single fluid and its specific properties are deduced from long ran order prevailing in momentum space. It is shown that the theory mathematically equivalent to a two-fluid model. In this interpret the flow of the superfluid is not necessarily irrotational. Applica tions are made to rotating bucket experiments and to the flow thr tubes. Agreement with experiments is satisfactory. R.Eisensch

536.48 : 530.

MULTIPLE FORMATION OF ELEMENTARY EXCITATIONS He II. See Abstr. 11858

536.48 : 53

THEORY OF SOLID He^3. See Abstr. 11544

536.48 : 530.

12187. POSSIBLE SUPERFLUIDITY OF A SYSTEM OF STRON INTERACTING FERMIONS.
L.N.Cooper, R.L.Mills and A.M.Sessler.
Phys. Rev., Vol. 114, No. 6, 1377-82 (June 15, 1959).

The possible superfluidity of a system of strongly interactin fermions is investigated on the assumption that an adequate desc tion of the system in its "normal" state is given by independent fermions in a momentum-dependent potential. On the basis of th assumption it is investigated whether a correlated wave-function the form used by Bardeen, Cooper, and Schrieffer minimizes the ground-state energy. The non-zero terms in the expectation val of the Hamiltonian contain the modified kinetic energy and the ful two-body potential between the fermion pairs. An integral equati is obtained in configuration space for the correlation function between pairs. This integral equation is meaningful even for pot tials with hard cores, and a non-zero solution implies the existen of a superfluid state. A variational method is devised which pro vides a criterion for superfluidity and a lower bound for the tran ition temperature into the superfluid state. It is found that a rep ive hard core does not in principle forbid the existence of a supe fluid state, but whereas in the absence of a hard core an attracti two-body potential always leads to a superfluid state at sufficien low temperatures, in the presence of a repulsive core there appe to be a critical strength of attraction needed to form a superfluid state. When the variational principle is applied to liquid He^3 or nuclear matter, it is found for a wide class of trial functions tha the system does not become a superfluid.

536.623

12188. A HIGH-TEMPERATURE CALORIMETER FOR THE ACCURATE MEASUREMENT OF THE HEATS OF REACTION OF GAS-LIKE SUBSTANCES. F.E.Wittig and W.Schmatz. Z. Elektrochem., Vol. 63, No. 4, 470-80 (1959). In German.

A new calorimeter of the Wittig and Huber type is described in detail. It can be used up to 700°C to obtain heats of reaction to 1%. Results are given for the heat of formation of ammonia at 550°C. S.Weintroub

536.631

12189. THE HEAT CAPACITY AND THERMODYNAMIC FUNCTIONS OF β-URANIUM HYDRIDE FROM 5 TO 350°K. R.E.Flotow, H.R.Lohr, B.M.Abraham and D.W.Osborne. J. Amer. Chem. Soc., Vol. 81, No. 14, 3529-33 (July 20, 1959).

Measured in an adiabatic calorimeter. The enthalpy and entropy at 298.15°K calculated from the data are 2155 cal $mole^{-1}$ and 15.24 cal deg^{-1} $mole^{-1}$, respectively. The entropy and free energy of formation for UH_3 at 298.15°K as well as the heat of formation at absolute zero, were calculated from these data and the previously determined heat of formation and have the values −43.60 cal deg^{-1} $mole^{-1}$, −17 353 cal $mole^{-1}$ and −27 945 cal $mole^{-1}$. It was found that the calculated and observed dissociation pressures are not in agreement. The discrepancy is believed due to a particle size effect in the dissociation pressure measurements or to the heat of transition from α-UH_3 to β-UH_3. An anomaly is observed in the heat capacity which arises from the transition from the ferromagnetic to the paramagnetic state. The maximum in the heat capacity is 10.72 cal deg^{-1} $mole^{-1}$ and occurs at 170.7 ± 0.5°K. It was estimated that 1.01 cal deg^{-1} $mole^{-1}$ is the entropy change in the transition which is less than R ln 2 = 1.38 cal deg^{-1} $mole^{-1}$ expected from the Heisenberg theory of ferromagnetism.

536.631

12190. CONTRIBUTION OF THE NUCLEUS TO THE SPECIFIC HEAT OF RHENIUM. P.H.Keesom and C.A.Bryant. Phys. Rev. Letters, Vol. 2, No. 6, 260-1 (March 15, 1959).

Results, shown graphically, of measurements of the heat capacity of Re between 0.37°K and 4.2°K in the normal and superconducting states are reported and discussed. In zero magnetic field the specific heat was $C_n = \gamma T + \alpha T^3 + A_0 T^{-2}$ ($T > 1.85$°K) and $C_s = C_{es} + \alpha T^3 + A_0 T^{-2}$ ($T < 1$°K) in millijoule/mole°K where $\gamma = 2.31 \pm 0.02$, $\alpha = 0.026 \pm 0.002$, and $A_0 = 0.052 \pm 0.002$. C_{es}, the electronic specific heat, is expressed by $\gamma T_c a \exp(-bT_c/T)$ for $T_c/T > 2$ where $a = 8.5$, $b = 1.46$ and $T_c = 1.70$°K. The Debye characteristic temperature at 0°K is 417 ± 10°K. In a field of 1000 Oe, the specific heat was given by $\gamma T + \alpha T^3 + A_H T^{-2}$ where $A_H = 0.06 \pm 0.01$. The possibility that, by interaction between the nuclear electric quadrupole moment and the crystalline electric field, the energy levels of the nucleus are separated sufficiently to produce the anomalous T^{-2} contribution to the specific heat, is discussed. S.Weintroub

536.631

12191. NUCLEAR SPECIFIC HEAT OF GALLIUM AND ZINC. G.Seidel and P.H.Keesom. Phys. Rev. Letters, Vol. 2, No. 6, 261-2 (March 15, 1959).

The data for Ga and Zn obtained by the authors (Abstr. 5634 of 1959) and for Zn by Phillips (Abstr. 2352 of 1959) and Zavaritskii (Abstr. 1360 of 1959) are reviewed in the light of the possible interaction of the nuclear quadrupole moment with the gradient of the crystalline field. (See preceding abstract). S.Weintroub

536.631

12192. SPECIFIC HEATS OF $PrCl_3.nH_2O$ AND $LaCl_3.nH_2O$ IN THE TEMPERATURE RANGE BETWEEN 4.8°K AND 260°K. K.H.Hellwege, U.Johnsen and W.Pfeffer. Z. Phys., Vol. 154, No. 3, 301-9 (1959). In German.

A 40 cm^3 adiabatic calorimeter was used to measure the difference ($C_{Pr} - C_{La}$) of the specific heats of the salts and C_{La}, as a function of the temperature. Hence, C_{Pr} was calculated. ($C_{Pr} - C_{La}$) = magnetic specific heat of $PrCl_3.nH_2O$ and this is compared with the value obtained from spectroscopic data. The entropies of the salts were calculated from the specific heat data. The results are shown in both graphical and tabular form. S.Weintroub

THERMODYNAMICS

536.7

12193. THERMODYNAMICS. J.M.Smith and G.M.Brown. Industr. engng Chem., Vol. 51, No. 3II, 472-80 (March, 1959).

A valuable list of substances and systems is given with references to newer and up-to-date data relating to pvT and critical properties, to vapour pressure, to heat capacity, to general thermodynamic properties, to heat of mixing, to binary and ternary vapour—liquid equilibrium, to liquid—liquid equilibrium, to equilibrium constants, and to heats of reaction. W.Good

536.7 : 535.325

12194. SOME THERMODYNAMIC PROPERTIES OF THE SYSTEM t-BUTANOL + WATER. J.Kenttämaa, E.Tommila and M.Martti. Ann. Acad. Sci. Fennicae A II, No. 93, 20 pp. (1959).

The refractive indices, densities, viscosities, heat capacities, molar heats of mixing, and vapour—liquid equilibria of the system t-butanol + water were determined over the whole range of mixtures at various temperatures. From the results the values of the following quantities were determined: partial molar volumes, partial molar heats of mixing, azeotropic properties, excess free energy and excess entropy. The data are compared with the values given in the literature for the other simple aliphatic alcohols. The results are discussed.

536.7

12195. THERMODYNAMIC FUNCTIONS AND AUXILIARY DATA FOR THEIR CALCULATION FOR CARBON AND HYDROGEN AND SOME OF THEIR COMPOUNDS FOR THE TEMPERATURE RANGE 1000 TO 50 000°K. H.Kroepelin, K.K.Neumann and E.Winter. Abhandl. Braunschw. Wiss. Gesell., Vol. 10, 166-94 (1958). In German.

The formulae and the sources of the data used are briefly discussed. Calculated values of the following are listed in 24 tables: the molar free enthalpy functions from 1000° to 6000°K for C, H_2, H, CH, CH_2, CH_3, CH_4, C_2H_2, C_2H_4 and C_2; equilibrium constants for the formation of all the substances except C; terms in the electronic partition functions for H and C up to 50 000°K; and the molar volume and number of particles per cm^3 at 1 bar and temperatures up to 50 000°K. S.Weintroub

536.7

12196. THERMODYNAMIC PROPERTIES OF Cu—Ni AND Fe—Co SOLID SOLUTIONS. Ya.I.Gerasimov, A.A.Vecher and V.A.Geiderikh. Dokl. Akad. Nauk SSSR, Vol. 122, No. 5, 834-6 (1958). In Russian.

The e.m.f. of various alloys was measured over the temperature range 600-750°C and thus determined the free energy, heat, and entropy of formation of the Cu—Ni alloys as functions of composition at 1000°K, and the activity of Fe in the alloy Fe—Co at 1000°K. There is evidence for the existence of an ordered Cu—Ni phase, but no data are presented on its composition. M.G.Priestley

536.7 : 541.135.5

12197. THE THERMODYNAMIC PROPERTIES OF COPPER—PALLADIUM ALLOYS. A.A.Vecher and Ya.I.Gerasimov. Dokl. Akad. Nauk SSSR, Vol. 123, No. 5, 868-9 (1958). In Russian.

The e.m.f. generated at 600°-760°C by a cell

$$Cu|Cu^+ \text{ (a fused mixture of NaI and KI)}|\ Cu—Pd \text{ alloy}$$

was measured in an atmosphere of purified argon, and from the experimental results the free energy, heat, and entropy of solution of Cu—Pd alloys were determined. Although at the temperatures employed all the experimental alloys were in the disordered state, the deviation of the thermodynamic functions from the ideal laws, high negative values of the heat of solution, and the displacement of the minima on the heat of solution and free energy curves towards the Cu ends of the diagrams, all pointed to the existence of a superstructure in these alloys at lower temperatures. M.H.Sloboda

536.7 : 532.77

STATISTICAL THERMODYNAMICS OF POLYMER SOLUTIONS. See Abstr. 11903

536.71

12198. THERMODYNAMIC AND SPECTROSCOPIC STUDY OF PYRROLIDINE. I. THERMODYNAMIC PROPERTIES IN THE SOLID, LIQUID, AND VAPOR STATES. D.L.Hildenbrand. G.C.Sinke, R.A.McDonald, W.R.Kramer and D.R.Stull. J. chem. Phys., Vol. 31, No. 3, 650-4 (Sept., 1959).

The low-temperature heat capacity, heat of combustion, heat of vaporization, and vapour pressure of pyrrolidine were measured. The information obtained is as follows: the heat capacity of the solid from 14° to 215°K; the liquid heat capacity from 215° to 312°K; a heat of transition of 127 cal mole^{-1} at 207.14°K; a heat of fusion of 2053 cal mole^{-1} at the melting point, 215.31°K; the entropy of the liquid at 298.15°K, 48.78 cal mole^{-1} deg^{-1}; the standard heat of formation from the elements at 298.15°K, −9.81 kcal mole^{-1}; the heat of vaporization at 298.15°K, 8990 cal mole^{-1}; and the vapour pressure, $\log_{10}P(mm) = 6.888\,16 - 1157.40/(t + 202.332)$. From a comparison of the calorimetric entropy of the ideal gas with statistically calculated values based upon newly obtained spectroscopic data, pyrrolidine vapour appears to have the indefinitely puckered cyclopentane type structure. Thermodynamic properties of the solid, liquid, and ideal gas are tabulated at selected temperatures. For Pt II, see Abstr. 12052.

ELECTRICITY

ELECTROSTATICS . DIELECTRICS

537.221

12199. THE GENERATION OF STATIC CHARGE ON HIGH POLYMER. S.Kittaka.
J. Phys. Soc. Japan, Vol. 14, No. 4, 533-8 (April, 1959).

The generation of static electricity by the contact and separation between high polymer substances and metals was studied. The combinations: polystyrene—Pt, Acrylite (polymethylmethacrylate)—Pt, and Teflon (polytetrafluorethylene)—Pt were examined. It was observed that the surrounding conditions have serious effects on the quantity and sign of the static charge generated. A mechanism of generation of the electrostatic charge has been proposed assuming the energy levels of the localized electrons on the surface of high polymer substances and the change of these energy levels by the absorption of different gases. It was estimated that work functions of polystyrene, Acrylite, and Teflon are 5.74, 5.48 and 5.04 eV, respectively.

537.222

12200. MEASUREMENT OF DIELECTRIC SURFACE CHARGE DENSITY. H.Seiwatz.
Phys. Rev. Letters, Vol. 2, No. 9, 398 (May 1, 1958).

In determining the quantity of charge transported across an electrode–dielectric interface during the charging of a capacitor by measuring the surface charge density on the dielectric after removal of one electrode of the capacitor, Townsend discharge occurs in the air gap as the electrode is removed. This produces a considerable change in surface charge density. Calculations of charge density based on a Townsend discharge agree with experimental values. R.C.Glass

537.226

12201. A SURVEY OF THE THEORY OF DIELECTRICS. H.Fröhlich.
Arch. Sci. (Geneva), Vol. 12, Special No., 5-8 (1959).

1959 Maxwell-Ampere Conference paper (see Abstr. 11542 of 1959). A review of the general theory of dielectrics with emphasis on the extent to which macroscopic treatments can be used. There are four general types of dielectric absorption all but one being well understood. Future work should be directed to applications of the general theory. J.G.Powles

537.226.08 : 621.372.413

12202. CAVITY RESONATORS FOR DIELECTRIC SPECTROSCOPY OF COMPRESSED GASES. H.E.Bussey and G.Birnbaum.
Rev. sci. Instrum., Vol. 30, No. 9, 800-4 (Sept., 1959).

Convenient, tunable, sealed-off cavity resonators are described at frequencies of 1, 2, 9 and 24 kMc/s for use with internal pressures up to 1000 lb/in^2. The modes of oscillation employed were TE_{01n}, TE_{11n}, and TM_{01} hybrid, all in a circular cylinder. A convenient method for sealing an iris, applicable over a wide frequency range, is to insert a tapered Teflon plug. A Kovar-glass seal for coaxial lines is described that provides a good impedance match in a 50 ohm line. The measuring procedure is described. Accuracy of dielectric loss measurements was increased by calibrating the loss changes of the cavity arising from reresonating it upon admission of lossless gas.

537.226.1 : 539.2

12203. THEORY OF DIELECTRIC RELAXATION IN MOLECULAR CRYSTALS. J.D.Hoffman.
Arch. Sci. (Geneva), Vol. 12, Special No., 36-51 (1959).

1959 Maxwell-Ampere Conference paper (see Abstr. 11542 of 1959). A review of the theory of dielectric loss in molecular crysts showing multimodal loss curves in terms of multiplicity of energy wells and barriers to molecular reorientation. Applications to loss in long-chain substances is discussed. J.G.Powles

537.226.1 : 539.1

12204. DIELECTRIC SATURATION AND MOLECULAR STRUCTURE. A.Piekara, S.Kielich and A.Chełkowski.
Arch. Sci. (Geneva), Vol. 12, Special No., 59-65 (1959).

1959 Maxwell-Ampere Conference paper (see Abstr. 11542 of 1959). A theory of positive dielectric saturation due to intramolecular effects and in particular due to the effect of the field on a gauche—trans equilibrium. J.G.Powle

537.226.1 : 539.1

12205. THEORY OF DIELECTRIC ABSORPTION DUE TO ROTATIONAL OSCILLATIONS IN CRYSTALLINE LONG CHAIN SUBSTANCES. B.Szigeti.
Arch. Sci. (Geneva), Vol. 12, Special No., 66-8 (1959).

1959 Maxwell—Ampere Conference paper (see Abstr. 11542 of 1959). An absorption due to rotational oscillations is predicted for crystalline long chain substances as one or more bands in the one mm wavelength region. If found, this should give information on intermolecular forces. J.G.Powle

537.226.

12206. THE EFFECTIVE CONDUCTIVITY AND PERMITTIVITY OF POLYCRYSTALLINE SEMICONDUCTORS. APPLICATION TO FERRITES. P.M.Prache and J.Rozes.
Cables et Transm., Vol. 12, No. 4, 292-302 (Oct., 1958). In Frenc

A model for the calculation of the frequency variation of the complex permittivity of multilayer dielectric materials is extended to granular materials embedded in a matrix of another material. It is shown how the electrical properties of the granular material and the binder may be obtained separately, using experimental results on the frequency variation of the dielectric properties of the mixture. Manganese—zinc and nickel—zinc ferrites are treated as examples. A.J.Manue

537.226

12207. ON THE DIELECTRIC LOSSES IN IMPURE IONIC CRYSTALS. T.Ninomiya.
J. Phys. Soc. Japan, Vol. 14, No. 1, 30-4 (Jan., 1959).

Mechanisms of the dielectric loss due to vacancy—impurity complexes are examined by considering effects of polarization of both impurity and lattice ions. It is found that these effects cause dielectric loss, and a loss curve is well represented by a Debye-type curve. It is pointed out that these effects may remove the quantitative discrepancy between previous theory and experiments

537.226

12208. THE THEORY OF THE DIELECTRIC CONSTANT OF POLYDISPERSE EMULSIONS. E.S.Rajagopal.
J. India Inst. Sci. A, Vol. 40, No. 4, 152-8 (Oct., 1958).

The distortion of a homogeneous dielectric liquid sphere place in a uniform electric field is investigated. The results agree with those of Thacher and O'Konski (1953), obtained by a different procedure. The effect of this distortion on the static dielectric consta of polydisperse emulsions is considered and it is shown that the eff increases if the particle sizes are increased. The exact shape assumed by the liquid drop in the electric field is investigated and shown to be a surface of revolution of a higher transcendental cur

537.226.1

2209. DOMAIN FORMATION IN FERROELECTRICS.
..Jaśkiewicz.
.cta phys. Polon., Vol. 16, No. 1-2, 169-71 (1957).
The free energy of cone shaped domains is calculated in terms f the wall energy, spontaneous polarization, applied voltage and eneral shape and depolarizing factors. The critical size for such omains to become stable is deduced and it is shown that domains arallel to the field are more likely to grow than antiparallel ones.
K.W.Plessner

537.226.2 : 539.2

2210. THE COMPLEX PERMITTIVITY OF ICE CRYSTALS.
[.Gränicher and C.Jaccard.
.rch. Sci. (Geneva), Vol. 12, Special No., 52-8 (1959).
1959 Maxwell—Ampere Conference paper (see Abstr. 11542 of 959). A résumé of the dielectric properties of ice interpreted in erms of crystal defects. J.G.Powles

537.226.2

2211. THE MECHANISM OF DIELECTRIC RELAXATION LOSSES N CRYSTAL HYDRATES. I.Ts.Lyast.
zv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 3, 276-8 (1958).
n Russian. English summary: PB 141041T-3, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.
Dielectric relaxation losses are caused by translation, as well s rotation, of polar molecules. The polarization caused by diffusion f the loosely-bound water molecules is discussed and a formula for he losses derived. A maximum loss occurs for a particular water ontent and the value calculated for gypsum agrees well with experi- ment. The effect of the extra diffusion resulting from crystal defects s small. R.C.Kell

537.226.2

2212. THE DIELECTRIC CONSTANT OF THE BISMUTHATES OF SOME METALS. A.M.Kashtanova and G.I.Skanavi.
zv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 3, 319-20 (1958).
n Russian. English summary: PB 141041T-3, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.
Well-sintered ceramics were obtained from Bi_2O_3 with up to 5% of various metal oxides. Some bismuthates had higher dielectric onstants than those of corresponding titanates. Most of them had a elatively high resistivity. Unlike the titanates, the temperature oefficient of the dielectric constant was positive. R.C.Kell

537.226.2

12213. THE STATE OF WATER MOLECULES SORBED ON Al_2O_3 BY DIELECTRIC MEASUREMENTS. G.Ebert.
Arch. Sci. (Geneva), Vol. 12, Special No., 78-80 (1959).
1959 Maxwell-Ampere Conference paper (see Abstr. 11542 of 1959). Dielectric measurements in the range 10^5 to 7×10^6 c/s, 25° to −60° C for water content up to 0.1 g/g. The results are interpreted in terms of reorientation of "de-adsorbed" molecules.
J.G.Powles

537.226.2

12214. DIELECTRIC CONSTANT OF LIQUID SULFUR HEXA-FLUORIDE. D.Berg.
J. chem. Phys., Vol. 31, No. 2, 572-3 (Aug., 1959).
The dielectric constant at -50° C is 1.81 between 10 and 500 kc/s, in excellent agreement with the value calculated from the Clausius—Mossotti equation. The loss tangent is less than 0.001.
R.F.S.Hearmon

537.226.2

12215. DIELECTRIC BEHAVIOUR OF ALCOHOL SOLUTIONS.
C.Brot and A.Soulard.
Arch. Sci. (Geneva), Vol. 12, Special No., 9-13 (1959). In French.
1959 Maxwell—Ampere Conference paper (see Abstr. 11542 of 1959). Measurements of the static dielectric constant of solutions of n-hexanol in n-hexane at 25° C and 50° C over the complete concentration range. Results are interpreted in terms of formation of chains of hydrogen bonded alcohol molecules. J.G.Powles

537.226.2 : 539.19

12216. INTRAMOLECULAR DIPOLE MOTION IN AMINES AND ETHERS FROM DIELECTRIC MICROWAVE MEASUREMENTS ON DILUTE SOLUTIONS. G.Klages, F.Hufnagel and H.Kramer.
Arch. Sci. (Geneva), Vol. 12, Special No., 14-19 (1959).
1959 Maxwell-Ampere Conference paper (see Abstr. 11542 of 1959). A study of the dielectric absorption of some amines, ethers and similar molecules in dilute solution in a non-polar liquid at 300, 1.5 and 0.7 cm wavelength at 20° C. The absorption is represented by two terms, one associated with reorientation of the molecule as a whole and the other with the reorientation of the dipole alone.
J.G.Powles

537.226.2

12217. DIELECTRIC RELAXATION IN DILUTE SOLUTIONS.
W.Maier.
Arch. Sci. (Geneva), Vol. 12, Special No., 20-3 (1959).
1959 Maxwell—Ampere Conference paper (see Abstr. 11542 of 1959). The dielectric relaxation times have been measured for a series of chlorine substituted anisoles and a series of substituted diphenyl ethers in dilute solution in benzene at 20° C. Evidence is found for internal mobility of the methoxy group in the anisoles and of the phenol groups in two of the diphenyl ethers. J.G.Powles

537.226.2 : 539.19

12218. THE DIELECTRIC PROPERTIES OF SOME PHENOLS.
A.H.Price.
Arch. Sci. (Geneva), Vol. 12, Special No., 31-5 (1959).
1959 Maxwell-Ampere Conference paper (see Abstr. 11542 of 1959). The dielectric properties of 2 : 6 diisopropyl phenol, hydroquinone dimethyl ether and 2 : 6 dimethoxyphenol, pure and in solution in decalin, benzene or carbon tetrachloride from 10^5 c/s to 10^{10} c/s at room temperature. The results are discussed in terms of steric hindrance to rotation of the phenol group by ortho substituents. J.G.Powles

537.226.2

12219. THE EFFECT OF THE TYPE OF CATION, ATTACHED TO CELLULOSE IN THE PROCESS OF CATIONIC EXCHANGE REACTION, ON THE DIELECTRIC LOSSES OF CONDENSER PAPER.
V.T.Renne and M.N.Morozova.
Zh. tekh.,Fiz., Vol. 28, No. 9, 1999-2003 (1958). In Russian.
The authors repeated Church's work [Journal of the Society of Chemical Industry, Vol. 66, No. 7, 221-6 (July, 1947)] and investigated also the influence of the type of attached cation on tan δ. It was found that: (a) metallic cations (even in small amounts −0.05 to 0.1% by weight) strongly affect the electric properties of paper: (b) for temperatures above 0° C, bivalent cations do not affect tan δ, monovalent cations increase tan δ (the effect increasing with decrease in the radius of the cation), and trivalent cations increase tan δ less than monovalent cations: (c) for temperatures below 0° C, metallic cations markedly increase the dipole maximum of tan δ for cellulose. The influence of cations increases with their radius and their valency. M.W.Makowski

537.226.2

12220. THE DIELECTRIC PROPERTIES OF SINGLE CRYSTALS OF $BaTiO_3$ AT A FREQUENCY OF 1000 Mc/s. J.Fousek.
Czech, J. Phys., Vol. 8, No. 2, 254-5 (1958).
At room temperature multi-domain single crystals of barium titanate have a permittivity $\epsilon'(10^9)$ at 10^9 c/s which is smaller than that at low frequencies, $\epsilon'(10^3)$ at 1 kc/s for example. Although the absolute values of ϵ' varied widely for different crystals, presumably because they came from different melts and had different domain structures, the ratio $\epsilon'(10^9)/\epsilon'(10^3)$ was approximately constant, within the limits 0.7 to 0.8. At 10^9 c/s ϵ' was found to depend on the position on the hysteresis loop, thus contradicting earlier findings by other workers who found no dependence above 6×10^5 c/s.
A.E.Kay

537.226.2

12221. DIRECT OBSERVATION OF ANTIPARALLEL DOMAINS DURING POLARIZATION REVERSAL IN SINGLE-CRYSTAL BARIUM TITANATE. R.C.Miller and A.Savage.
Phys. Rev. Letters, Vol. 2, No. 7, 294-6 (April 1, 1959).
It has been found possible to distinguish antiparallel domains using polarized light and transparent (liquid) or semitransparent (metal) electrodes without the aid of a cross-field. The reasons for the slight difference in shade which distinguishes the two types of c-domain is not known. Observations made during polarization reversal confirm the existence of extensive sidewise domain wall movement with both low and high applied fields. Wall velocity is very much higher with liquid than with metal electrodes.
K.W.Plessner

537.226.2

12222. FERROELECTRIC PROPERTIES OF A MATERIAL MADE OF TITANIUM OXIDE. L.Nicolini.
Nuovo Cimento, Vol. 13, No. 2, 257-64 (July 16, 1959).

A ceramic-type material was prepared from TiO_2 by a technique previously described (Abstr. 830 of 1952). Although this material is very similar to rutile, its properties are quite different. Suitable specimens were prepared in order to prove the existence of ferroelectric properties, and results are shown graphically: (1) The variations of the capacity against bias voltage; (2) the hysteresis loops with varying temperatures and voltages; (3) variations in the dielectric constant in a wide range of temperatures, from -60°C to $+350^{\circ}$C. These results prove the existence of ferroelectric phenomena.

537.226.3

12223. THE PRODUCTION AND PROPERTIES OF NEW ELECTRETS FROM INORGANIC DIELECTRICS.
A.N.Gubkin and G.I.Skanavi.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 3, 330-42 (1958).
In Russian. English summary: PB 141041T-3, obtainable from Office of Technical Services, U.S.Dept. of Commerce, Washington, D.C., U.S.A.

The possibility of forming electrets in inorganic ceramic dielectrics is investigated. The materials which are examined include $MgTiO_3$, $ZnTiO_3$, $BaO.4TiO_2$, $CaTiO_3$, $SrTiO_3$, $BaTiO_3$, KBr, bismuth strontium titanate, steatite and porcelain. The results are summarized in tables. The optimum conditions for forming are given, and the discharge behaviour is investigated. L.E.Cross

537.226.3

12224. MULTI-COMPONENT ORGANIC ELECTRETS.
Yu.Ya.Yanson.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 3, 359-60 (1958).
In Russian. English summary: PB 141041T-3, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

From investigations on a number of mixtures of organic substances the author finds that the "best" electret is produced from a mixture of 40% Brazil wax, 40% colophony and 20% beeswax. Data are given for the character of this electret with different modes of forming. It is suggested that dipolar orientation, electron injection and internal conduction may make significant contributions to the electret polarization. L.E.Cross

537.226.3

12225. EXPERIMENTS ON ELECTRETS OF CARNAUBA WAX AND THE FORMATION OF THEIR HETEROCHARGE.
J.van Calker and W.Fröhlich.
Ann. Phys. (Leipzig), Folge 7, Vol. 4, No. 1-5, 216-24 (1959).
In German.

The frozen-in charge was determined by reheating the wax and integrating the reverse current as the charge is released. Charging and polarization currents were also measured. The results are interpreted in terms of a space-charge polarization theory due to MacDonald (Abstr. 457 of 1954). The concentration of mobile ions, their mobility and a relaxation time are calculated.
K.W.Plessner

537.226.3 : 537.312.5

12226. ANISOTROPIC POLARIZATION OF PHOTOELECTRETS FROM SINGLE CRYSTAL SULPHUR.
I.S.Zheludev and V.M.Fridkin.
Kristallografiya, Vol. 3, No. 2, 182-5 (1958). In Russian.

Single crystals of supposedly orthorhombic S were polarized in various directions and it was shown that the anisotropic polarization depended on the anisotropic photoconductivity of single crystal S. It is concluded that the S crystals were actually monoclinic and that measurement of photoelectric charge provides a method of investigating the anisotropy of photoconductivity in crystals. See also Abstr. 7085-6, 10000 (1957), 3075, 3132 (1958), 12928 (1959).
R.F.S.Hearmon

537.227

12227. APPARATUS FOR MEASURING THE PYROELECTRIC POLARIZATION IN CRYSTALS.
I.M.Sil'vestrova and Yu.N.Sil'vestrov.
Kristallografiya, Vol. 3, No. 1, 57-63 (1958). In Russian.

A detailed description, including circuit diagrams, is given of the electronic apparatus, and of the microthermometer, capable of measuring a temperature change of ~ 0.01 deg C. Measurements were made of the pyroelectric constant of tourmaline and of ethylen diamine tartrate. For the latter, a value of 2.5 c.g.s.-e.s.u./cm^3 de was found. R.F.S.Hearmon

537.228 : 532.5

12228. DIPOLAR ROTATION EFFECT IN LIQUIDS. E.Grossetti.
Nuovo Cimento, Vol. 13, No. 2, 350-3 (July 16, 1959).

The rotation moment values are reported for some polar liquid (toluene, nitrobenzene, ethyl alcohol, amyl alcohol, methyl alcohol, distilled water, acetic acid) in a rotating electric field at frequencie 8.5, 12.0 and 23.0 Mc/s, in order to determine by a different metho the viscosity coefficient values. This was accomplished by determining η with Born's formula, when the values for M of the electric moment, measured in the polarization processes according to Debye's formula, are substituted in it. For certain liquids, howeve (toluene, nitrobenzene, acetic acid), the values obtained in this way for η are noticeably different from those obtained by classical measurements, e.g. by the Ostwald's viscometer.

537.228.1

12229. THE QUESTION OF DETERMINING THE PIEZOMODULUS d_{31} FROM THE RADIAL VIBRATIONS OF A DISK. L.A.Shuvalov.
Kristallografiya, Vol. 3, No. 1, 106-9 (1958). In Russian.

A formula is derived for calculating d_{31} from the frequency of radial vibrations; it is shown that the method does not depend critically on the value of Poisson's ratio. R.F.S.Hearmon

ELECTRIC CONDUCTION
SEMICONDUCTORS

537.3 : 621.317.727 : 621.316.72

12230. CONSTANT CURRENT SUPPLY FOR THE POTENTIOMETER. E.E.Watson.
Amer. J. Phys., Vol. 27, No. 6, 404-7 (Sept., 1959).

The e.m.f. of an ordinary lead acid storage cell is dependent o the currents that have been drawn from the cell during the preceding hours. A circuit, using two dry cells and a storage cell, which will maintain a current through a potentiometer constant to better than 0.001% for periods of at least ten minutes, is described. A similar arrangement will provide constant current through two resistances which are to be compared by the potentiometer method.

537.311.1 : 530.1

12231. THE GENERAL THEORY OF TRANSPORT: THE DIFFERENCE BETWEEN ELECTRIC FIELD AND DENSITY GRADIENT. T.Kasuya.
J. Phys. Soc. Japan, Vol. 14, No. 4, 410-15 (April, 1959).

The difference between the electric currents due to the extern electric field and the gradient of the chemical potential is discusse based on the general theory of transport coefficients. In the limit of weak magnetic field ($\hbar\omega \ll \kappa T$, where ω is Larmor frequency, κ Boltzmann constant, T absolute temperature) and weak collision ($\hbar/\tau \ll \kappa T$, where τ means the relaxation time), Einstein relation is applicable. In the limit of strong magnetic field, the current du to the gradient of the chemical potential exhibits the oscillatory behaviour similar to that of diamagnetism.

537.311.1 : 536.212.

12232. ELECTRICAL AND THERMAL CONDUCTIVITY OF MONOVALENT METALS; THE INFLUENCES OF COULOMB INTERACTION. T.Kasuya and K.Yamada.
J. Phys. Soc. Japan, Vol. 14, No. 4, 416-35 (April, 1959).

Electrical and thermal conduction phenomena are discussed b taking account of the effects of Coulomb interaction and Umklapp processes of electron–phonon collisions. The contributions of ele tron binary collisions through screened short-range Coulomb pote tial to relaxation processes are evaluated. The effect on the coupling parameter of electron–phonon interaction is also considered in the range of the Umklapp process. The effect of phonon drag is not considered.

537.311.3

12233. THE THEORY OF THE INNER FIELD-EMISSION FROM THE VALENCE BAND. W.Franz.
Z. Naturforsch., Vol. 14a, No. 4, 415-18 (April, 1959). In German.

A calculation of the transition probability from valence to conduction band in a high electric field, due to Keldysh (Abstr. 7827 of 1958), is corrected, the result then being identical with a formula derived by Homilius (Abstr. 8321 of 1954) for the special case of cubic crystals. A new calculation, taking into account electron-hole interaction, is carried out. K.W.Plessner

537.311.31

12234. METHODS OF SOLUTION OF THE BLOCH INTEGRAL EQUATION AT LOW TEMPERATURES. V.Glaser and B.Jakšić.
Period. math.-phys. astron. (Zagreb), Vol. 12, No. 4, 257-67 (1957).

Supek has shown (Abstr. 4951 of 1958) that the fundamental Bloch integral equation in the theory of conductivity of metals can be reduced at low temperatures to a differential equation on the Fermi surface E = const. The authors discuss Supek's transformation and, by using a variational principle for the Bloch's equation, arrive at a more rigorous derivation of the differential equation. The method is then generalized to a case when, apart from an electrical field, a static magnetic field is present. J.K.Skwirzynski

537.311.31

12235. RESISTIVITY OF THIN TIN LAYERS.
F.Ciorăscu, M.Nachman and M.Oncescu.
Rev. de Physique (Bucarest), Vol. 3, No. 2, 107-18 (1958).

The resistance of the films was measured under accurately specified conditions. The variation with thickness and temperature was studied. When the temperature of the film is changed, the change in resistance is sometimes irreversible, indicating an irreversible change in structure. The resistance depends not only on the temperature during the measurement, but also on the temperature at which the film was deposited; this may be attributed to a difference in granular structure. P.M.Davison

537.311.31 : 539.2

12236. THE ELECTRICAL CONDUCTIVITY OF COPPER TAKING INTO ACCOUNT THE ANISOTROPY OF THE LATTICE VIBRATION SPECTRUM. H.Bross.
Z. Naturforsch., Vol. 14a, No. 5-6, 560-80 (May-June, 1959).
In German.

The vibration spectrum was calculated from the interaction between nearest ions. Frequency and polarization vector were found to depend on the direction of the propagation vector, from which follows that the probability $W(k,k')$ for the scattering of an electron by the lattice vibrations does not depend only on $|k-k'|$. The transport equation was then solved by a variation principle. Calculated values of the conductivity at various temperatures are in agreement with experiment, as well as the calculated magnetoresistance at low temperature. The anisotropy also causes deviations from the Matthiessen rule at low temperatures. L.Pincherle

537.311.31 : 539.234

RESISTANCE OF ANNEALED Pb EVAPORATED FILMS. See Abstr. 11597

537.311.32

12237. THE INFLUENCE OF THE VALENCY STATES OF CATIONS ON ELECTRICAL CONDUCTIVITY OF Mg—Mn FERRITE. S.Krupička and K.Závěta.
J. Electronics and Control, Vol. 6, No. 4, 333-6 (April, 1959).

The relation between the valency states of Mn and Fe ions and the resistivity of the iron-deficient Mg—Mn ferrite is established. The high resistivities measured can be understood, even in the case when some Fe^{2+} ions are present, under the assumption that stable pairs Mn^{4+}—Fe^{2+} are formed, thus preventing Fe^{2+} ions from taking part in an easy conduction mechanism.

537.311.32 : 536.212

CONDUCTIVITY OF Te SINGLE CRYSTALS. See Abstr. 12168

537.311.33

12238. ARRAYS OF INORGANIC SEMICONDUCTING COMPOUNDS. A.J.Cornish.
J. Electrochem. Soc., Vol. 106, No. 8, 685-9 (Aug., 1959).

Arrays of compounds related to the periodic chart of the elements can be prepared. These arrays aid in estimating the physical and chemical properties of compounds, including semiconducting properties. Many compounds included in the arrays may not exist; however, if the compound does exist, the value of its melting point, energy gap, and electron mobility generally fit into a uniform pattern related to adjacent compounds. The crystal structure of semiconducting compounds is shown to be of only second-order importance. Grouping semiconducting compounds by crystal types loses the overall relations that exist between many compounds.

537.311.33

12239. A THEORY OF IMPURITY CONDUCTION. I. T.Kasuya.
J. Phys. Soc. Japan, Vol. 13, No. 10, 1096-110 (Oct., 1958).

Treated by considering the following three ranges of impurity atom concentration: (1) The concentration is fairly large and the impurity levels merge into the conduction bands, the impurity atoms act as scatters. (2) The concentration is fairly small and the impurity levels split from the conduction bands. The energy width of this impurity band is, however, determined mainly by the translational energy of electrons in this band. (3) The concentration is very small and the width of the impurity band is determined mainly by the fluctuation of the local potential energy. In this paper, the first two cases are covered. For this purpose, the general theory of transport phenomena is developed and the condition that the ordinary Boltzmann—Bloch equation is applicable is given. The result of impurity conduction given by Conwell is obtained as a limiting case of the present formula. However, the condition that Conwell's formula is applicable is not satisfied in actual cases.

537.311.33

12240. ON THE ORIGIN OF ELECTROMOTIVE FORCES IN SEMICONDUCTORS. J.Tauc.
Semiconductors and phosphors (see Abstr. 9597 of 1959) pp. 486-90.
In German.

Using concepts from irreversible thermodynamics, and confining attention to a definite simple example, the origin of an e.m.f. in a semiconductor is discussed. The example consists of a semiconductor annulus, with a cut which enables two electrodes to be attached; part of the annulus is under the influence of uniform irradiation. P.T.Landsberg

537.311.33

12241. ON THE PLASMA THEORY OF ELECTRONIC SEMICONDUCTORS. E.Groschwitz.
Semiconductor and phosphors (see Abstr. 9597 of 1959) pp. 501-10.
In German.

The plasma of electrons and holes is discussed within the framework of Lorentzian electron theory. P.T.Landsberg

537.311.33

12242. SURFACE CONDUCTIVITY UNDER CONDITIONS OF CHARGE-CARRIER SCATTERING AT THE SURFACE, FOR SMALL DISTORTION OF THE BANDS AT THE SURFACE. H.Flietner.
Ann. Phys. (Leipzig), Folge 7, Vol. 3, No. 7-8, 396-413 (1959).
In German.

The conductivity of the space-charge layer parallel to the surface of semiconductors under conditions of surface scattering is calculated, for the case of a small amount of raising of the bands at the surface, as may be achieved, for example, by the field-effect. The results are expressed in terms of effective hole and electron mobilities and are compared with experimental data. C.A.Hogarth

537.311.33

12243. ON THE VARIATION OF IONIZATION ENERGY IN IMPURITY SEMICONDUCTORS. M.L.Chetkarov.
C.R. Acad. Bulg. Sci., Vol. 10, No. 4, 269-72 (July-Aug., 1957).
In Russian.

The impurity ionization energy W for concentration N is treated in terms of a model due to Frenkel [Zh. eksper. teor. Fiz., Vol. 8, 1292 (1938)] in which impurity atoms form a "lattice", with repeat distance $N^{-1/3}$, in a medium (the semiconductor) of dielectric constant ϵ. Expressions are derived for the variation of W with N and for the electrical conductivity in strong fields. C.H.L.Goodman

537.311.33

12244. IMPURITY MOLECULE-IONS AND IMPURITY MOLECULES. R.R.Haering.
Canad. J. Phys., Vol. 37, No. 3, 384 (March, 1959).

The possibility is pointed out of the chance formation of impurity molecule-ions, besides impurity molecules, in heavily compensated samples of semiconductors. The internuclear distance in such molecule-ions is not determined by the minimum in the electronic energy, but is fixed by the impurity concentration. The formation of such impurity states is being investigated theoretically using the effective mass approximation. L.Pincherle

537.311.33

12245. ON THE MAGNETO-RESISTIVE CHANGE IN ANISOTROPIC SEMICONDUCTORS. L.Rothkirch.
Z. Naturforsch., Vol. 14a, No. 7, 683-4 (July, 1959). In German.

The dependence of the effect on the orientation of the magnetic field is investigated on certain simplifying assumptions.
P.T.Landsberg

537.311.33 : 535.337

QUANTUM MAGNETO-ABSORPTION PHENOMENA IN SEMICONDUCTORS. See Abstr. 12016

537.311.33 : 535.337

FINE STRUCTURE ON THE ABSORPTION EDGE IN SEMICONDUCTORS. See Abstr. 12017

537.311.33 : 538.613 : 535.56

FARADAY EFFECT OF THE MOTT EXCITON. See Abstr. 12156

537.311.33 : 539.12

12246. ON THE COEFFICIENT OF ABSORPTION OF Co^{60} γ-RAYS IN SEMICONDUCTORS.
B.I.Boltaks, B.T.Plachenov and E.V.Semenov.
Dokl. Akad. Nauk SSSR, Vol. 123, No. 1, 72-5 (1958). In Russian.

The coefficient of absorption of γ-rays with energies 1.17 and 1.33 MeV was measured for various semiconductors. As a check on calibration, measurements were also made on Al, Pb and Zn. Comparisons with theoretical predictions based on Compton scattering and photoelectric absorption (usually a small contribution) show discrepancies of 15-20% in the case of semiconductors, compared with about 5% for the metals. The absorption in semiconductors is also found to be temperature dependent, and appears to follow closely the number of current carriers present. A careful theoretical analysis of the effect is clearly necessary. G.P.McCauley

537.311.33

12247. ON THE RELATION BETWEEN NON-STOICHIOMETRY AND THE FORMATION OF DONOR AND ACCEPTOR CENTRES IN COMPOUNDS. F.A.Kröger.
J. Phys. Chem. Solids, Vol. 7, No. 2-3, 276-8 (Nov., 1958).

Discusses the number of donors or acceptors formed when extra atoms of one of the components are incorporated in the lattice in various ways — interstitial sites, vacancy formation, anti-structure mechanism. R.Stratton

537.311.33

12248. DELINEATION OF JUNCTIONS IN SEMICONDUCTORS BY ELECTROSCOPIC POWDERS. J.A.Amick and B.Goldstein.
J. appl. Phys., Vol. 30, No. 9, 1471-2 (Sept., 1959).

Techniques are described for delineating junctions with dry powders or with suspensions of triboelectrically charged powders. The advantages over other methods are the simplicity and speed, the semi-permanent nature of the outline formed, and the ability to delineate the positive or negative side of a junction, as desired.
B.T.M.Willis

537.311.33

12249. ROLE OF SINGLE PHONON EMISSION IN LOW-FIELD BREAKDOWN OF SEMICONDUCTORS AT LOW TEMPERATURES. M.A.Lampert, F.Herman and M.C.Steele.
Phys. Rev. Letters, Vol. 2, No. 9, 394-7 (May 1, 1959).

Electrical breakdown at low temperatures and at low field strengths, due to impact ionization of shallow impurities, has been observed in p- and n-germanium, but never in silicon. It is suggested that in Si a "hot" carrier can lose a large fraction of its energy through emission of a single phonon, either acoustical or optical, before it reaches the energy sufficient for impurity ionization. This hypothesis is supported by the known band structure and phonon spectrum. There remain difficulties in establishing a sufficient condition for low-field breakdown. Data for Ge doped with deep-lying acceptors are discussed and new experiments are suggested.
L.Pincherl

537.311.3

12250. PROPERTIES OF A SEMICONDUCTOR SURFACE AS DETERMINED FROM A MODIFIED DRIFT MOBILITY EXPERIMENT. N.J.Harrick.
Phys. Rev. Letters, Vol. 2, No. 5, 199-200 (March 1, 1959).

The emitter circuit is modified by making capacitative coupling to the surface through a slice of strontium titanate 10^{-2} cm thick. A discussion is given of the sort of information about the surface which can be obtained and typical results are given for a 35 ohm cm p-type germanium sample. D.J.Olive

537.311.33 : 539.21

12251. SURFACE EFFECTS ON THE DIFFUSION OF IMPURITIES IN SEMICONDUCTORS. F.M.Smits, R.C.Miller and R.L.Batdorf.
Semiconductors and phosphors. See Abstr. 9597, pp. 329-37.

The effect of semiconductor surface conditions on the diffusion of impurities into them is considered. In the diffusion of Group III and Group V impurity elements in Ge, the main surface effect is a rate process for the transport of diffusing material across the interface in the absence of a liquidus layer. Due to this rate process the surface concentration approaches the equilibrium concentration at a finite rate. In Si significant evaporation occurs at the temperatures needed to diffuse Group III and Group V impurity elements, and this makes it possible to obtain steady state layers with an exponential impurity distribution. Evidence is obtained that the [111] plane is a stable plane with respect to the evaporation of Si.
J.B.Birk

537.311.3

12252. ELECTRICAL PROPERTIES OF A FEW BINARY SEMICONDUCTING COMPOUNDS. D.N.Nasledov.
Semiconductors and phosphors. (See Abstr. 9597 of 1959) pp. 641-6
In German.

This is a brief outline of the main directions along which work is being carried out at the Leningrad Institute of Technical Physics. After listing the types of III-V, II-VI and mixed compounds being investigated, InSb and InAs are singled out for a more detailed description of electrical properties, viz. conductivity, Hall effect and their temperature and magnetic field dependence.
K.W.Plessne

537.311.3

12253. TERNARY SEMICONDUCTING COMPOUNDS $A^{I}B^{V}B^{VI}_{2}$.
L.D.Dudkin and A.P.Ostranitsa.
Dokl. Akad. Nauk SSSR, Vol. 124, No. 1, 94-7 (Jan. 1, 1959).
In Russian.

Four compounds were studied: $CuSbSe_2$, $AgSbSe_2$, $AgSbTe_2$ and $AgBiSe_2$, with melting points at 472, 634, 561 and 792° C, respectively ($AgBiSe_2$ showed a polymorphic transformation at 298° C). Electric and thermal conductivity, thermoelectric power and microhardness were measured. Thermal activation energies were (in eV): $AgSbSe_2$ 0.58; $CuSbSe_2$, 0.16 and 0.80; $AgBiSe_2$, 0.34 (low temperature form) and 1.10 (high temperature form). A chemical bonding scheme is suggested in which A^{I+} ions are situated in a covalently bonded $(B^{V}-B^{VI})^{-}$ structure. See also Abstr. 3458 (1959).
C.H.L.Goodma

537.311.

12254. ON NEW SEMICONDUCTING COMPOUNDS WITH THE CHALCOPYRITE STRUCTURE. O.G.Folberth and H.Pfister.
Semiconductors and phosphors (see Abstr. 9597 of 1959) pp. 474-6.
In German.

The following $A^{II}B^{IV}C_2^{V}$ compounds were examined: $ZnSiP_2$, $ZnGeP_2$, $ZnGeAs_2$, $CdGeAs_2$ and $CdSnAs_2$. All are semiconductors and have the chalcopyrite structure with tetrahedral coordination between atoms. The ratio c/a is slightly less than 2, indicating a tetragonal distortion from the zinc blende structure. The electron Hall mobility of polycrystalline $CdSnAs_2$ was measured as 3000 cm^2 $volt^{-1}$ sec^{-1}. B.T.M.Will

537.311.33 : 539

12255. ON THE DRIFT MOBILITY OF ELECTRONS IN SILVER CHLORIDE. P.Süptitz.
Semiconductors and phosphors. (See Abstr. 9597 of 1959) pp. 429-
In German.

The drift velocity was determined from the depth of the colori

ion produced by light and electrical impulses simultaneously applied to the crystal surface. The method assumes that the mean lifetime of an electron exceeds the duration of the impulses, but variations for different samples cut from the same crystal indicated that this assumption was not necessarily valid. The variations are partly ascribed to the effect of small concentrations of foreign ions (Cd, Ca, Pb). B.T.M.Willis

537.311.33 : 539.2

12256. DISORDER PROPERTIES OF SILVER IODIDE. H.J.Oel. Semiconductors and phosphors. (See Abstr. 9597 of 1959) pp. 431-4. In German.

The "low-temperature phase" of silver iodide (below 145°C) has either the wurtzite or zinc blende structure, and the "high-temperature phase" has a disordered cubic structure. A discussion is given of the electrical and optical properties of these phases and of the conditions of existence of the two low-temperature forms. B.T.M.Willis

537.311.33 : 537.533

RESONANCE POTENTIALS IN THIN FILMS OF POTASSIUM CHLORIDE. See Abstr. 11124

537.311.33

12257. TEMPERATURE DEPENDENCE OF THE ELECTRICAL PROPERTIES OF BISMUTH—ANTIMONY ALLOYS. A.L.Jain. Phys. Rev., Vol. 114, No. 6, 1518-28 (June 15, 1959).

The electrical resistivity ρ and Hall effect R of zone-levelled single crystals of Bi--Sb alloys were measured in the temperature range from 4.2°K to 300°K. Log(ρ/ρ_{300}) versus 1/T curves suggest thermal activation of carriers in the concentration range from 5% to 40% Sb in the temperature range from 25°K to 100°K; approximate activation energies have been inferred from their slopes. The activation energy appears to have a maximum at a concentration near 12%. Some anomalies have been observed in the behaviour of ρ and R on both sides of this concentration at low temperatures. Lattice parameters for these alloys have also been measured for the entire range of solid solubility. Both a maximum and minimum in the c-axis lattice parameter versus concentration occur near the concentration at which anomalies appear in transport properties. These phenomena are discussed in terms of a simple band model proposed by Blount and Cohen.

537.311.33

12258. STUDIES OF THE SEMICONDUCTING PROPERTIES OF THE COMPOUND CsAu. W.E.Spicer, A.H.Sommer and J.G.White. Phys. Rev., Vol. 115, No. 1, 57-62 (July 1, 1959).

Data are presented showing CsAu to be a semiconductor. The optical absorption curve is typical of a semiconductor with a threshold for direct optical excitation across the gap between 2.6 and 3.3 eV and exciton peaks at about 2.6, 3.0, and 3.3 eV. A relatively high optical absorption at smaller photon energies may indicate an indirect absorption process. Additional information has been obtained by measuring the spectral response curve of the photoemission from CsAu. The resistivity of the material is approximately 0.01 ohm cm over the range from 410°K to 4.2°K, indicating either degeneracy or impurity banding. X-ray studies show that CsAu has a CsCl structure and a lattice constant of 4.263 ± 0.001 A. Finally, some preliminary results obtained with other alkali metal—gold compounds are described.

537.311.33

12259. ON THE SEMICONDUCTING PROPERTIES OF CUPROUS OXIDE. XII. THE CONDUCTIVITY OF CUPROUS OXIDE AT HIGH TEMPERATURES AND LOW PRESSURES. K.Stecker. Ann. Phys. (Leipzig), Folge 7, Vol. 3, No. 1-2, 55-69 (1959). In German.

For Pt XI, see Abstr. 10179 (1954). In a partially evacuated enclosure there exists a pressure difference between two regions of different temperature ($p \propto \sqrt{T}$). It is pointed out that this Knudsen effect, and the allowance made for it in the evaluations of experiments, has tended to falsify the curves given by earlier authors. It is held that the Knudsen effect need not be allowed for, and that then the conductivity behaves as $p^{1/8}$, where p is the oxygen pressure, in the region of 700° to 1000°C. P.T.Landsberg

537.311.33

12260. ON THE SEMICONDUCTING PROPERTIES OF CUPROUS OXIDE. XIII. CONDUCTIVITY MEASUREMENTS ON CUPROUS OXIDE WHEN THERMAL EQUILIBRIUM IS DISTURBED. K.Stecker. Ann. Phys. (Leipzig), Folge 7, Vol. 3, No. 1-2, 70-81 (1959). In German.

The diffusion coefficient of copper vacancies is estimated from electrical conductivity measurements, and the results are discussed. P.T.Landsberg

537.311.33

12261. ON THE TEMPERATURE DEPENDENCE OF THE p-ABSORPTION BANDS IN GERMANIUM. R.Kessler. Semiconductors and phosphors (see Abstr. 9597 of 1959) pp. 375-9. In German.

In p-Ge there are low temperature absorption bands at 3.4, 4.7, and 10 μ lying between the band edge at 1.9 μ and the start of the lattice bands at 15 μ, although these bands do not show up in n-Ge. The band strengths are proportional to the hole concentrations. Measurements of optical absorption, Hall coefficient R, and resistivity ρ, are made as functions of temperature from 20°K to 300°K and it is pointed out that measurements of R and ρ do not necessarily determine all the simple parameters of p-Ge unless some other data are available to verify the effective mass values. C.A.Hogarth

537.311.33

12262. RECOMBINATION PROPERTIES OF NICKEL IN GERMANIUM. G.K.Wertheim. Phys. Rev., Vol. 115, No. 1, 37-47 (July 1, 1959).

A study of lifetime in germanium containing nickel impurities has shown that the recombination process must be interpreted in terms of a multilevel model, with three charge states assigned to nickel. At room temperature the electron-capture cross-section of neutral nickel is 0.96×10^{-16} cm^2, and that of singly negative nickel is 5.9×10^{-16} cm^2; the capture constants in both cases are independent of temperature. The cross-section of doubly negative nickel for holes is approximately 1×10^{-14} cm^2; no information on the temperature dependence of this cross-section has been obtained. Lifetime data are in good agreement with the known energy levels and solid solubility. The results are compared with those in the literature.

537.311.33 : 535.337

INTRINSIC RECOMBINATION EMISSION IN GERMANIUM. See Abstr. 12015

537.311.33

12263. RECOMBINATION OF ELECTRONS AND HOLES ON NICKEL ATOMS IN GERMANIUM. S.G.Kalashnikov and K.P.Tissen. Fiz. tverdogo Tela, Vol. 1, No. 4, 545-52 (April, 1959). In Russian.

The authors studied the effect of temperature on the electron lifetime in p-type germanium containing nickel. The electron capture constants for the upper (C_{n_2}) and lower (C_{n_1}) levels of nickel did not depend greatly on temperature and their ratio was $C_{n_1}/C_{n_2} \cong 6$. The capture constants did not depend on the hole density either. The observed dependences of the electron lifetime on temperature and hole density agreed well with the theoretical statistics of recombination at traps with two energy levels. The lower level of nickel was found to lie 0.17 eV above the valence band. A.Tybulewicz

537.311.33

12264. MAGNETIC SUSCEPTIBILITIES OF PHOTO-GENERATED CURRENT CARRIERS IN GERMANIUM. J.O.Kessler and A.R.Moore. Phys. Rev. Letters, Vol. 2, No. 6, 247-9 (March 15, 1959).

Describes a method not subject to the same limitations as previous "subtraction methods". The change in magnetism of the specimens, suspended in an inhomogeneous magnetic field, owing to injection of hole-electron pairs by external light is measured directly. The values of magnetic susceptibility χ are several hundred times larger than expected and the results are discussed in relation to the variation of χ with T, incident photon flux and the Landau—Peierls theory. G.C.Williams

537.311.33

12265. DEPENDENCE OF THE ELECTRON AND HOLE LIFETIMES IN GERMANIUM ON CARRIER DENSITY. V.G.Alekseeva, I.V.Karpova and S.G.Kalashnikov. Fiz. tverdogo Tela, Vol. 1, No. 4, 529-34 (April, 1959). In Russian.

Dependence of the electron and hole lifetimes in n-type germanium, alloyed with phosphorus, and in p-type germanium, alloyed with boron, on the concentration of these two elements was

studied. It was found that phosphorus and boron produce low-resistivity germanium with large carrier lifetimes. Comparison of the observed dependences with the recombination statistics shows that at majority carrier densities $\leq 2 \times 10^{17}$ cm^{-3} the capture constants of traps do not depend on electron and hole densities. It follows that at densities mentioned above the process of collision (impact) recombination in germanium is of little importance.

A.Tybulewicz

537.311.33

12266. FIELD EFFECT AND REACTIONS AT THE SURFACE OF GERMANIUM. H.Flietner.
Ann. Phys. (Leipzig), Folge 7, Vol. 3, No. 7-8, 414-27 (1959).
In German.

The conductivity modulation due to the field effect was measured while the specimens were exposed to wet or dry N_2, O_2 or ozone. The distribution of surface states, both "slow" and "fast", is deduced from the results and a reaction sequence is suggested to account for the observed effects. This involves three types of state: acceptor states at crystal faults and ledges, adsorbed oxygen ions and GeO_2 formation. Ozone is thought to cause adsorbed oxygen to recombine to form O_2 gas, so leaving only the first type of surface state behind.

K.W.Plessner

537.311.33 : 539.231

SURFACE PROPERTIES OF GERMANIUM. See Abstr. 11595

537.311.33

12267. LATTICE MOBILITY OF THERMAL AND HOT CARRIERS IN GERMANIUM. E.M.Conwell.
Sylvania Technol., Vol. 12, No. 2, 30-6 (April, 1959).

The mobility of carriers in germanium around room temperature decreases as a result of increasing the temperature or the applied electric field. The mobility is determined by the interaction of the carriers with the thermal vibrations of the lattice atoms. Recent information obtained about the thermal vibrations, and new theoretical calculations, have provided a better insight into the influence of temperature and field on the mobility. An account of the theory of lattice mobility incorporating the new developments is presented.

537.311.33

12268. MEASUREMENT OF THE DRIFT MOBILITY, ELECTRICAL RESISTANCE AND THE LIFETIME OF MINORITY CHARGE CARRIERS IN N- AND P-GERMANIUM AT HIGH HYDROSTATIC PRESSURES. G.Landwehr.
Z. Naturforsch., Vol. 14a, No. 5-6, 520-31 (May-June, 1959).
In German.

The method of measurement was based on the observation of resistance modulation by injected carriers using rectangular voltage pulses. The drift mobility of holes was found to increase linearly with pressure, by about 1.4% at 10 000 kg/cm^2. The change in conductivity of p-type Ge was in good agreement with this change, indicating that the carrier concentration was not pressure-sensitive. The electron mobility was found to decrease with pressure in a non-linear manner, being 8% down at 10 000 and 15% at 14 000 kg/cm^2. The mobility figures are interpreted in terms of the energy band structure of germanium. An effect on lifetime was observed which showed strong hysteresis and which became smaller after each pressure cycle.

K.W.Plessner

537.311.33

12269. THE MAGNETORESISTANCE OF GERMANIUM IN THE TEMPERATURE RANGE OF 10 TO 20°K. H.Schultz.
Semiconductors and phosphors (see Abstr. 9597 of 1959) pp. 451-2.
In German.

Reports briefly experimental results on n- and p-Ge specimens at 10-20°K and 78°K at field strengths up to 24 kOe. The results suggest that at 10°K any quantization effects are still negligible.

C.A.Hogarth

537.311.33

12270. POTENTIAL MEASUREMENTS DURING JET ETCHING OF P-TYPE Ge AND P-TYPE Si. P.F.Schmidt and M.Blomgren.
J. Electrochem. Soc., Vol. 106, No. 8, 694-700 (Aug., 1959).

Potential measurements were made during jet etching, and the feasibility of the method was established. Potentials during jet etching were compared with those obtained in bath operations by other authors.

537.311.33 : 548.5 : 621.315.59

ON THE TECHNIQUE OF GROWING SINGLE CRYSTALS OF N—P—N GERMANIUM. See Abstr. 11621

537.311.33

12271. THE DOPING OF INDIUM ARSENIDE WITH METALS OF THE FIRST SUB-GROUP OF THE PERIODIC SYSTEM.
E.Schillman.
Semiconductors and phosphors (see Abstr. 9579 of 1959) pp. 511-14.
In German.

The influence on the electrical properties of very pure InAs of the addition of Cu, Ag, and Au, was considered. Measurements of the Hall effect showed that in no case was a doping effect evident. The results were supported by other observations.

J.Thewlis

537.311.33

12272. ANOMALOUS ELECTRICAL PROPERTIES OF P-TYPE INDIUM ARSENIDE. J.R.Dixon.
J. appl. Phys., Vol. 30, No. 9, 1412-16 (Sept., 1959).

Hall constants and resistivities have been measured as a functi of carrier concentration for zinc-doped, single crystal p-type indiun arsenide at temperatures ranging from 4.2 to 500°K. For carrier concentrations greater than 2×10^{17} cm^{-3} the electrical properties appear to be normal for a material of this type. However, for smaller carrier concentrations anomalies appear which consist of dips and double reversals in the Hall constant-temperature relationship. These results are in agreement with data reported by Folbert and Weiss (Abstr. 8199 of 1956) for polycrystalline material. A mechanism involving inhomogeneities arising from the inclusion of microscopic n-type regions in p-type material is proposed to explai the anomalies. Such small n-type regions could arise from the aggregation of impurities about dislocations. On the basis of this model, it is predicted that the anomalies should be removed by appropriate heat treatment of the material. The prediction is confirmed by experiment. Recent work of Rupprecht suggests that the anomalous behaviour of p-type InAs is due to an n-type surface laye which can be introduced by grinding or polishing, and removed by etching. This is consistent with the mechanism proposed here.

537.311.33 : 536.212

THERMAL CONDUCTIVITY OF SEMICONDUCTING CRYSTALS OF InSb. See Abstr. 12167

537.311.3

12273. SOME EFFECTS OF FAST NEUTRON IRRADIATION ON CARRIER LIFETIMES IN SILICON.
R.W.Beck, E.Paskell and C.S.Peet.
J. appl. Phys., Vol. 30, No. 9, 1437-9 (Sept., 1959).

Single crystal specimens of silicon have been exposed to fast neutrons from a reactor source to determine the room temperature effects of irradiation on carrier lifetimes. For highly n- and p-type material the approximate lifetime damage constants, defined as $1/\tau = 1/\tau_i + \alpha\phi$, are found to be $\alpha_n = 4.4 \times 10^{-7}$ (nvt)$^{-1}$ sec^{-1} and $\alpha_p = 1.2 \times 10^{-6}$ (nvt)$^{-1}$ sec^{-1}. Two possible positions of the dominant recombination level are 0.36 eV below the conduction band, or 0.33 eV above the valence band. Further agreement with the value of α_p has been obtained by measuring high level lifetime in silicon junction diodes.

537.311.33 : 538.27

PARAMAGNETIC RESONANCE IN ELECTRON-IRRADIATED SILICON. See Abstr. 11242-3

537.311.33

12274. JUNCTION DELINEATION ON SILICON IN ELECTRO-CHEMICAL DISPLACEMENT PLATING SOLUTIONS. D.R.Turner.
J. Electrochem. Soc., Vol. 106, No. 8, 701-5 (Aug., 1959).

Antimony, copper, silver, platinum, and gold can be deposited on silicon by electrochemical displacement. The displacement plating process induces potential differences between abraded and polished n- and p-type silicon. This results in metal being deposited at different rates on the four types of silicon surfaces which in turn produces p—n junction delineation. The process also shows up abrupt changes in the impurity concentration at the surface. The maximum resolution between junctions in a multiple junction crystal is about 2 microns.

537.311.33

12275. ELECTRON BOMBARDMENT OF SILICON. D.E.Hill.
Phys. Rev., Vol. 114, No. 6, 1414-20 (June 15, 1959).

The electrical properties of single crystal silicon have been

vestigated as a function of bombardment with high-energy elec-ons. Measurements of the initial carrier removal rate were arried out at 273°K for samples with widely different carrier con-entrations. A second type of experiment involved the measurement f the temperature dependence of resistivity and Hall coefficient at ifferent stages of the bombardment. Bombardment-produced nergy levels were found at 0.03, 0.17 and 0.4 eV below the edge of ie conduction band. With 4.5 MeV electrons, the introduction rates or these levels were 11, 0.5 and 0.05 cm^{-1}, respectively. Bombard-ient levels were also found at 0.05 and 0.3 eV above the edge of the alence band. With 4.5 MeV electrons the introduction rates for iese levels were 13 cm^{-1} and roughly 0.3 cm^{-1}, respectively. radiations with 700 keV electrons indicate the presence of the ame defect levels with correspondingly smaller introduction rates. n investigation of the irradiation-induced mobility changes for egenerate p-type silicon indicates that, for each hole removed from ie valence band, there appears a singly-charged scattering centre. or near-degenerate n-type samples, the mobility changes are much maller. Results of bombardments at 78° and 10°K show that the et damage rate decreases by a factor of 2 or more when bombard-ients are carried out at lower temperatures.

537.311.33

2276. EXCESS NOISE IN NARROW GERMANIUM P—N UNCTIONS. T.Yajima and L.Esaki.
. Phys. Soc. Japan, Vol. 13, No. 11, 1281-7 (Nov., 1958).

Excess noise has been studied on junctions fabricated of heavily oped p-type and n-type germanium with less than 200 A junction vidth, which exhibit inverted rectification and negative resistance in he forward direction. Considerable 1/f noise has been observed in : forward range, the character of which is stable and surface in-ensitive. Moreover, the noise was found to be mainly associated vith the excess forward current that is peculiar to narrow p—n unctions. Measurements were made also at temperatures down to 77°K on both noise and static characteristics. The origins of the excess forward current and the associated excess noise are liscussed in connection with crystal imperfection.

537.311.33

12277. HIGH ELECTRIC FIELD EFFECTS IN GERMANIUM P—N JUNCTION. J.Yamaguchi and Y.Hamakawa.
J. Phys. Soc. Japan, Vol. 14, No. 1, 15-21 (Jan., 1959).

When squarewave pulses of 5-160 μsec duration with repetition rate of 1000 pulses per sec are impressed across germanium p—n junctions of grown type in the reverse direction, the critical voltage of the avalanche commencement rises with the temperature of the specimen. On the other hand, the onset voltage of negative resistance decreases with increasing ambient temperature of specimens and duration of pulse impressed across the p—n junction. Even if the ambient temperature of specimens is widely changed, the barrier temperature, which is estimated from the saturation current in the reverse direction, is almost constant. Therefore, the temperature rise in the barrier layer is also necessary for the onset of negative resistance, and avalanche ionization is essential. At the negative resistance region, the property of jumping or oscillation occurs. Which of the two prevails, depends on the circuit resistance and other experimental conditions. These properties seem to be related to the barrier temperature.

537.311.33

12278. INVESTIGATIONS OF P—N JUNCTIONS IN GERMANIUM WITH VARIOUS DENSITIES OF RECOMBINATION CENTRES. H.Dorendorf.
Z. angew. Phys., Vol. 11, No. 5, 162-4 (May, 1959). In German.

Variations of lifetimes of electrons and holes, reverse currents and short circuit photo-currents as a function of the concentration of nickel diffused into grown p—n junctions were measured and compared with theory. Except for reverse currents, where the measured values were consistently higher than predicted by theory, the agreement was good. G.C.Williams

537.311.33 : 621.315.59 : 621.317.61

12279. MEASUREMENTS OF THE CURRENT IN GERMANIUM N—P JUNCTIONS AS A FUNCTION OF TEMPERATURE. M.G.A.Bernard.
Semiconductors and phosphors. See Abstr. 9597. pp. 344-55. In French.

Measurements were made of the current—voltage characteristics and other related parameters of a number of Ge p—n junction diodes at temperatures down to −195°C. The results on one diode, which was studied in detail, agree well with contemporary theory and with calculations given in an appendix. The results for other diodes are not all so consistent, and this is attributed to complex impurity centres and surface effects at low temperatures. J.B.Birks

537.311.33 : 621.315.59

11280. TRAP CONCENTRATIONS IN GERMANIUM, THEIR DETERMINATION FROM LIFETIME MEASUREMENTS AND THE RELATION TO A PRACTICAL BREAKDOWN VOLTAGE IN P—N JUNCTION RECTIFIERS. F.W.G.Rose.
Semiconductors and phosphors. See Abstr. 9597. pp. 356-62.

An experimental relation was found between a practical breakdown voltage in alloyed p—n junction rectifiers and the trap concentration in the basic n-type Ge. The experiments involved resistivity and lifetime measurements with and without illumination at various temperatures on specimens of n-type Ge, which were then made into alloyed p—n junction rectifiers. Some theoretical aspects of the results are discussed. J.B.Birks

537.311.33

12281. A CONTRIBUTION TO THE STUDY OF THE EFFICIENCY IN A PHOTON EXCITED P—N JUNCTION IN SILICON. T.Stubb.
Comment. phys.-math. (Helsinki), Vol. 21, No. 1-8, 15 pp. (1958).

The efficiency is found to be very sensitive to the wavelength. Results are quoted for a black body at 5760°K giving an intensity of 0.1 W/cm^2. These indicate that the optimum thickness of the p-material is about 2.5μ and that the optimum efficiency is 14%. The output power is relatively constant for wavelengths between 0.8 and 1.05μ. D.J.Oliver

537.311.33

12282. OPTICAL CONTROL OF THE CHANGE OF SELENIUM RECTIFIERS. J.Kodes, J.Kroczek and J.B.Slavík.
Acta tech. (Prague), Vol. 4, No. 2, 132-8 (1959). In German.

The reflection coefficient of the Se layer, for white light, was measured with a Pulfrich photometer while the rectifier was undergoing a change at 140°C. The results indicate the nature of the selenium layer. R.Stratton

537.311.33 : 621.314.634

12283. SELENIUM RECTIFIERS WITH ARTIFICIAL LAYERS OF SELENIDES OF CADMIUM, TIN, BISMUTH AND LEAD. Y.Moriguchi.
J. Phys. Soc. Japan, Vol. 14, No. 2, 152-67 (Feb., 1959).

Artificial layers of selenides of Cd, Sn, Bi and Pb were made between the bulk Se and the counter electrode of selenium rectifiers by vacuum evaporation. The d.c. and a.c. characteristics of these rectifiers were observed in order to obtain information about the action of the barrier layer in normal selenium rectifiers. The results suggest that the role of the SnSe layer should never be neglected in the rectifying action of selenium rectifiers, as well as that of the CdSe layer, but the selenides of Bi and Pb seem to be undesirable materials.

537.311.33 : 621.314.632

12284. THE EFFECT OF PRE-ILLUMINATION ON THE CHARACTERISTICS OF CUPROUS OXIDE RECTIFIERS. R.Kužel.
Czech. J. Phys., Vol. 8, No. 1, 81-9 (1958). In Russian.

Description of experimental work carried out on cuprous oxide rectifying elements of 14 mm dia. It is shown that illumination of elements for several hours with intensive light, especially at elevated temperatures, up to 150°C, raises forward and reverse conductivity in such a manner that front to back ratio is improved. The effect of the illumination is practically permanent. The results of experiments are presented in graphs and the explanation of the phenomenon is proposed on the basis of semiconductor theory.
7 references. A.Woroncow

537.311.33 : 621.382.333.3

12285. THE EFFECT OF SURFACE AND VOLUME RECOMBINATION ON ALPHA AND THE REVERSE COLLECTOR CURRENT OF ALLOY CRYSTAL TRIODES. B.Ya.Moizhes.
Zh. tekh. Fiz., Vol. 28, No. 11, 2402-9 (1958). In Russian.

Using simplifications, analytical solutions are obtained for the distribution of minority carriers in the base of an alloy transistor, taking into account volume and surface recombination. From these

solutions expressions are obtained for the current gain, α, and the reverse collector current. It is concluded that in practical cases "excess" reverse current is usually due to conducting surface films, and not to the presence of recombination centres.

K.F.Hulme

537.311.33 : 538.561 : 621.373.5 : 621.382.22

12286. IMPROVED DIODE FOR THE HARMONIC GENERATION OF MILLIMETER- AND SUBMILLIMETER WAVES.
R.S.Ohl, P.P.Budenstein and C.A.Burrus.
Rev. sci. Instrum., Vol. 30, No. 9, 765-74 (Sept., 1959).

The only generally available source of monochromatic microwave energy in the shorter mm- and sub-mm-wave region is still some form of the point-contact silicon-diode harmonic generator, usually driven by a c.w. fundamental-frequency source operating in the 8-12 mm wave region. It has been found experimentally that the performance and stability of diodes for this application can be greatly improved by bombarding the silicon surface with positive ions. Described here are the methods used for the bombarding and mounting of silicon for this harmonic generating application, the construction of two practical waveguide circuits, the operating conditions for the most successful use of the material, and the measured high-frequency output is compared with that calculated on the basis of a simplified equivalent circuit for the harmonic generator.

537.312.5 : 621.383

12287. RELATIONSHIP BETWEEN SIGNAL-TO-NOISE RATIO AND THRESHOLD OF RESPONSE OF INFRARED PHOTOCONDUCTORS LIMITED BY GENERATION-RECOMBINATION NOISE. W.E.Spicer.
J. appl. Phys., Vol. 30, No. 9, 1381-4 (Sept., 1959).

For photoconductors in which the dominant noise is generation-recombination noise, it is shown that the s/n ratio is proportional to $\exp\beta E_i/2kT_D$, where E_i is the threshold response of the photoconductor, T_D is its temperature, and β is a constant between unity and one-half. If longer wavelength response is desired (smaller E_i) without sacrificing s/n ratio, this can only be achieved by lowering T_D. Similarly, for any given E_i, the generation-recombination noise can be reduced to an arbitrarily low level by lowering T_D sufficiently. Expressions are obtained for the optimum value of E_i under typical operating conditions.

537.312.5 : 535.37

PHOTOCONDUCTIVITY RELAXATION TIME MEASUREMENT. See Abstr. 12109

537.312.5 : 535.242.43 : 621.383

APPARATUS FOR CHECKING THE PROPORTIONALITY OF RESPONSE OF PHOTOCELLS. See Abstr. 11982

537.312.5 : 535.39

12288. ON THE OPTICAL PROPERTIES OF THIN PHOTOCONDUCTIVE LAYERS. THE CASE OF MICROCRYSTALLINE LAYERS OF LEAD SULPHIDE. V.Schwetzoff.
C.R. Acad. Sci. (Paris), Vol. 248, No. 20, 2859-61 (May 20, 1959). In French.

Evaporated layers of PbS, sensitized by oxygen treatment, show pronounced photoconductivity and have a refractive index n of about 2 compared with a value of n of about 4 for the pure sulphide. The anomaly can be explained by supposing the PbS crystals to be surrounded by a film of $PbO.PbSO_4$ (n = 2). The hypothesis is tested experimentally by comparing the optical properties and the photosensitivity of pure and oxygen-sensitized PbS layers over the spectral range 2.4-5.6 μ; photosensitivity is found to increase with absorption.

C.H.B.Mee

537.312.5

12289. DOPED SILICON AND GERMANIUM PHOTOCONDUCTORS AS TARGETS FOR INFRARED TELEVISION CAMERA TUBES.
R.W.Redington and P.J. van Heerden.
J. Opt. Soc. Amer., Vol. 49, No. 10, 997-1001 (Oct., 1959).

Several doped germanium and silicon photoconductors were investigated as targets for an infrared television camera tube. The performance of gold-doped silicon is outstanding. Its properties, sensitivity, speed of response, and freedom from various image retention effects are superior to those of a standard vidicon in the visible. It is within an order of magnitude of the maximum performance to be expected of a tube of the vidicon type. The other silicon dopings investigated were gallium, bismuth, and indium. These materials showed very little extrinsic photoconductivity. Copper-, gold-, silver-, and tellurium-doped germanium were also investigated. Targets prepared with all of these germanium dopings showed the development of an insensitive, nonimaging state in a few minutes' operation. The original imaging state could be recovered by a short change in operating conditions. This nonimaging state was demonstrated to be due to an induced surface conductivity.

537.312.

12290. PHOTO-VOLTAIC EFFECT IN Se-PHOTOCELLS HAVING ARTIFICIAL INTERMEDIATE LAYERS OF CdSe, CdTe, ZnSe AND ZnTe. H.Tubota and H.Suzuki.
J. Phys. Soc. Japan, Vol. 14, No. 1, 38-50 (Jan., 1959).

Measurements have been made of the photovoltages generated in Se-photocells which have each an artificial intermediate layer such as CdSe, CdTe, ZnSe and ZnTe. From the results obtained, the double barrier appears on both sides of the contact layers of selenide or telluride.

537.312.

12291. ON THE EFFECT OF SURFACE TREATMENT ON CERTAIN CHARACTERISTICS OF THE PHOTOCONDUCTIVITY OF CdS SINGLE CRYSTALS.
E.A.Sal'kov, G.A.Fedorus and M.K.Sheinkman.
Fiz. tverdogo Tela, Vol. 1, No. 4, 579-82 (April, 1959). In Russian.

The effects of (i) exposure to a gas discharge and (ii) heating in air at 200°C, on the variation with wavelength of photoconductive response (ϕ), photocarrier lifetime (τ) and quantum yield (η). (i) increased ϕ and τ, particularly below 5100 A, and slightly reduced η. This was ascribed to the formation of surface traps. (ii) was studied in less detail: it greatly increased ϕ and η, and slightly reduced τ. See also Abstr. 4609 (1959).

C.H.L.Goodma

537.312.5

12292. POLARIZATION OF PHOTOCONDUCTIVITY EXCITATION BANDS IN CdS SINGLE CRYSTALS. R.L.Kelly and W.J.Frederick
Phys. Rev. Letters, Vol. 2, No. 9, 389-90 (May 1, 1959).

Measurements were made of the wavelength corresponding to the photocurrent maximum in CdS crystals as a function of the angl of polarization of the incident light with respect to the c axis. The wavelength of the exciting light was a minimum with the electric vector parallel to the c axis ($\lambda_{\parallel}$ = 5069 A), and a maximum with the electric vector perpendicular ($\lambda_{\perp}$ = 5108 A). The shift in energ is explained using the Lambe–Klick–Birman model (Abstr. 5564 of 1959).

J.Franks

537.312.5 : 535.3

PHOTOCONDUCTIVITY OF POLYCRYSTALLINE CdSe. See Abstr. 12090

537.312.

12293. PHOTOELECTROMOTIVE FORCES IN PHOSPHORS.
P.Brauer.
Z. Naturforsch., Vol. 14a, No. 5-6, 556-9 (May-June, 1959). In German.

Irradiation of ZnS phosphors by monochromatic light in the lattice absorption region produces free carriers and a current resulting from their diffusion, which identifies them as electrons. In the tail of the absorption the current varies in direction but the carriers are usually holes. With either Cu or Ag activator and either Ga or Al coactivator, the displacement current changes sig at ~ 3350 A, with a comparatively small reversed current due to holes at longer wavelengths. The effect becomes zero at ~ 4800 A for Cu and ~ 4100 A for Ag, in agreement with relative activator levels, whereas the different trap depths of Ga and Al have no effect.

S.T.Henderso

537.312.5 : 535 3

PHOTOCONDUCTIVITY IN Ag-ACTIVATED Zn–Cd SULPHIDES. See Abstr. 12084

537.312.62

12294. PROBABILITY AND STATISTICS IN ELECTRIC CURREN THEORY. G.Pocholle.
Ann. Telecomm., Vol. 14, No. 3-4, 59-71 (March-April, 1959). In French.

Continuation of Abstr. 4947 (1958). Concerned mainly with the relationship between the superconductivity of a metal and its thermal spectrum. The theory is based on the Bose–Einstein formula.

V.G.Welsb

537.312.62

2295. ELECTROMAGNETIC PROPERTIES OF SUPER-CONDUCTORS. K.K.Gupta and V.S.Mathur.
Phys. Rev., Vol. 115, No. 1, 75-8 (July 1, 1959).

An integral relationship between the super-current and the vector potential of the electromagnetic field, similar to Pippard's phenomenological equation, is derived from the gauge-invariant theory of Wentzel. Expressions for coherence distance and penetration depth have been calculated.

537.312.62

2296. DETERMINATION OF THE SUPERCONDUCTING SKIN DEPTH FROM THE ENERGY GAP AND SUM RULE. M.Tinkham and R.A.Ferrell.
Phys. Rev. Letters, Vol. 2, No. 8, 331-3 (April 15, 1959).

The sum rule previously developed for thin films (Abstr. 4032 of 1958) is now extended to apply to bulk superconductors. From the observed behaviour of thin films, it follows rather generally that in bulk metal the relation between current and field must be non-local, and the penetration depth in pure metal is given by an expression agreeing closely with Pippard's (Abstr. 4106 of 1953).
R.G.Chambers

537.312.62

2297. SUPERCONDUCTING ELECTRONIC SPECIFIC HEATS, THE "EXPONENTIAL LAW", AND THE BARDEEN, COOPER, SCHRIEFFER THEORY. H.A.Boorse.
Phys. Rev. Letters, Vol. 2, No. 9, 391-3 (May 1, 1959).

The B.C.S. theory (Abstr. 1708 of 1958) is compared with recent data on Al, Zn and V, and it is concluded that for Al and Zn, significant discrepancies exist at temperatures below $T_c/4$.
R.G.Chambers

537.312.62

12298. RANGE OF ORDER OF SUPERCONDUCTING ELECTRONS. H.Meissner.
Phys. Rev. Letters, Vol. 2, No. 11, 458-9 (June 1, 1959).

In confirmation of work by Misener et al (Abstr. 442 of 1935; 818, 2349 of 1936), it is found that films of tin plated on copper or gold fail to become superconducting if less than about 0.4 μ thick, though much thinner films show superconductivity if the base is glass. It is suggested that the normal electrons in the base metal drift into the film and inhibit superconductivity.
R.G.Chambers

537.312.62

12299. EXCHANGE INTERACTION BETWEEN THE CONDUCTION ELECTRONS OF A SUPERCONDUCTOR AND THE [DISSOLVED] PARAMAGNETIC IONS. W.Baltensperger.
Helv. phys. Acta, Vol. 32, No. 3, 197-212 (1959). In German.

Effects are studied, using the B.C.S. theory for the electrons, and the model of Herring (1958) for the interaction. The critical temperature of the superconductor decreases almost linearly with the concentration of the ions. The phase transition is of the first kind. In the normal state the system is ferromagnetic with a Curie point proportional to the concentration. The theory is compatible with the measurements of Matthias, Suhl, and Corenzwit (1958) on La alloyed with rare earths, and those of Müller (1958) on V with transition metals. In a range of concentrations the superconductor, having disordered ion spins, makes a transition into a normal ferromagnetic phase at low temperatures. This will not happen, if the superconductor has a spin susceptibility in accordance to the measurements of Reif (Abstr. 5353 of 1957) because this allows an ordering of the spins.

537.312.62

12300. SUPERCONDUCTION IN MIXED CRYSTALS OF VANADIUM WITH THE TRANSITION ELEMENTS. J.Müller.
Helv. phys. Acta, Vol. 32, No. 3, 141-66 (1959). In German.

The influence of various transition metal solutes on the superconductivity of vanadium has been studied experimentally. Very pure mixed crystals were grown by simultaneous thermal decomposition of the iodides. The magnetically observed transition of unalloyed vanadium occurred at 5.30°K, the transition width in good samples being less than 0.03°. The variation of the critical temperature with fractional concentration c of the solutes is given by the following values of dT_c/dc (in 10^2 °K): Ti, + 0.08; Cr, –0.55; Mn, –0.9; Fe, –1.15; Co, –1.25; Ni, –1.0; Cu, –0.5. For pure V and some very dilute alloys, the magnetic field penetration data show the temperature dependence predicted by the B.C.S. theory. Part of the critical temperature variation is due to spin interaction of the conduction electrons with the magnetic ions, investigated theoretically by Baltensperger (preceding abstract). The interpretation of the results agrees qualitatively with the picture of Lomer and Marshall (see Abstr. 1281 of 1958) with regard to the numbers of localized electrons in vanadium-rich solid solutions.

537.312.62

12301. SUPERCONDUCTIVITY OF β MERCURY.
J.E.Schirber and C.A.Swenson.
Phys. Rev. Letters, Vol. 2, No. 7, 296-7 (April 1, 1959).

The β-phase of mercury, previously found to be the more stable below 79°K (Abstr. 6471 of 1958), shows a transition temperature T_c of 3.94°K, and an initial critical field slope of –170 gauss/degree. The critical field curve is not parabolic, as for α-Hg, but shows deviations similar to Sn and In. The change in T_c agrees with that expected from the change in atomic volume and the observed dT_c/dV for α-Hg. X-ray studies suggest that β-Hg may have b.c. tetragonal structure.
R.G.Chambers

537.312.62 : 538.2

12302. SUPERCONDUCTIVITY VERSUS FERROMAGNETISM IN LANTHANUM—GADOLINIUM ALLOYS.
R.A.Hein, R.L.Falge, Jr, B.T.Matthias and C.Corenzwit.
Phys. Rev. Letters, Vol. 2, No. 12, 500-2 (June 15, 1959).

Previous work (Abstr. 7980 of 1958) has been extended to temperatures below 1°K. A rapid change in behaviour is found at a Gd concentration (c) of about 1%; for c = 0.95%, a superconducting transition occurs at about 2°K, and for c = 0.98%, at about 1°K; for c = 1.0%, the material appears instead to become ferromagnetic at about 0.6°K.
R.G.Chambers

537.312.62

12303. THE INFLUENCE OF LATTICE DEFECTS ON THE TRANSITION TEMPERATURE OF DIFFERENT SUPER-CONDUCTORS. G.von Minnigerode.
Z. Phys., Vol. 154, No. 4, 442-59 (1959). In German.

Metal foils 10μ thick were severely cold-worked at 4°K. With Tl, Sn, In, Nb this produced a rise in transition temperature T_c of 0.1 - 0.3°K; with Pb there was no effect, and with Al, T_c remained below 1.3°K. Similar effects were produced by cold-working annealed evaporated films; with Hg, this treatment depressed T_c by 0.2°K. These changes in T_c are closely similar to the changes produced by evaporating on to a substrate cooled to 4°K, except that with Al the latter treatment produces a rise in T_c to 2.6°K.
R.G.Chambers

537.312.8

12304. THE INFLUENCE OF COMPOSITION AND DEGREE OF ORDER ON THE GALVANOMAGNETIC PROPERTIES OF ORDERING ALLOYS. M.D.Mochalov.
Fiz. Metallov. i Metallovedenie, Vol. 6, No. 5, 879-85 (1958). In Russian.

Resistivity (ρ) and Hall parameter (R) were measured for a series of Cu–Pd alloys (14-25 atomic % Pd) as functions of the degree of order. It was found that $R < 0$ and increases rapidly numerically during ordering. Also, during ordering, $R \propto \rho$. It is suggested that during ordering, there are changes in the ionic distribution in the lattice leading to an increase in the number of p-type charge carriers and also to a proportional increase in the number of centres which scatter them. When ordering is almost complete the linear relation between R and ρ breaks down as a result of the increase of the number of scattering centres to such a density that they interact with each other.
A.F.Brown

537.312.8

12305. QUANTUM THEORY OF GALVANOMAGNETIC EFFECT. I. BASIC CONSIDERATIONS.
R.Kubo, H.Hasegawa and N.Hashitsume.
J. Phys. Soc. Japan, Vol. 14, No. 1, 56-74 (Jan., 1959).

A quantum mechanical theory of the galvanomagnetic effect is developed on the basis of the general theory of irreversible processes previously reported by Kubo (Abstr. 8437 of 1957). The present theory applies to a Fermi surface of arbitrary shape, as far as it makes a closed surface in the momentum space. Complications due to the interband effect and Harper's broadening effect are neglected. With these assumptions it is proved that the static conductivity can be expressed generally in terms of the migration process of the centre coordinate of the cyclotron motion. This is

based on the assumption that the relative coordinates describing the cyclotron motion are essentially bounded quantities in classical and also in quantum-mechanical senses. Without referring to any dubious use of transport theory, a very satisfactory logical basis is thus obtained for treating the galvanomagnetic effect. This method is particularly useful for strong fields.

537.312.8

12306. RELAXATION TIME ANISOTROPY IN CADIUM SULPHIDE STUDIED WITH ELECTRICAL RESISTIVITY AND MAGNETO-RESISTANCE EFFECT. T.Masumi.
J. Phys. Soc. Japan, Vol. 14, No. 1, 47-56 (Jan., 1959).

Anisotropic temperature dependence of electrical restivity and magnetoresistance effect in hexagonal CdS single crystals were observed in several impurity-doped conducting and photoconducting crystals. The experimental results indicate unusual anisotropic behaviours. They seem to suggest that the relaxation time anisotropy plays an important role in transport phenomena of cadmium sulphide crystals having hexagonal crystal structure.

537.312.8

12307. THE INFLUENCE OF FAST HOLES ON THE PHOTO-ELECTROMAGNETIC EFFECT IN GERMANIUM.
A.K.Walton and T.S.Moss.
Proc. Phys. Soc., Vol. 73, Pt 4, 692-4 (April, 1959).

The variation of the short circuit p.e.m. current from a linear dependence on magnetic field has been found to be accurately quadratic up to 3140 Oe. The magnitude of the variation is 7-8% and is virtually isotropic. Assuming 2% fast holes and a formula for the magnetic dependence of the p.e.m. short-circuit current which does not include anisotropy terms the experimental results are fitted well with a ratio of fast to slow hole mobility of 6. W.Bardsley

537.312.8

12308. HALL EFFECT MEASUREMENT IN SEMICONDUCTOR RINGS. R.G.Pohl.
Rev. sci. Instrum., Vol. 30, No. 9, 783-6 (Sept., 1959).

The Hall effect can be measured in a ring-shaped sample placed in an alternating magnetic field normal to the plane of the ring. The resultant circular electric field produces a current around the ring proportional to the time derivative of the magnetic field. This current interacts with the magnetic field, establishing a Hall voltage between the inner and outer radii of the annulus. For extrinsic semiconductors with single effective mass charge carriers, this Hall voltage is, in m.k.s. units,

$$V_H = \mu\omega B_0^2(a^2 - b^2)\sin 2\omega t/8,$$

where μ is the mobility, ω the field angular frequency, B_0 the peak value of the magnetic field, a the inner radius, and b the outer radius. This technique eliminates voltages arising due to misaligned probes and end-effects in the conventional method. In addition, the measurement is independent of the conductivity for the case above. Experimental measurements on germanium, silicon, and indium antimonide rings yield mobility values in agreement with customary results.

537.312.8

12309. THE ANOMALY OF THE HALL COEFFICIENT OF LIGHTLY p-DOPED InAs. H.Rupprecht and H.Weiss.
Z. Naturforsch., Vol. 14a, No. 5-6, 531-5 (May-June, 1959).
In German.

From measurements of the p.d. between the Hall probes and two additional probes set between them on sandblasted and chemically treated surfaces, it is established that the anomalous variation of the Hall coefficient with temperature is derived from the formation of an n-type layer on the p-type specimen. G.C.Williams

537.312.9 : 537.323

12310. ELECTROMECHANICAL PROPERTIES OF SINGLE CRYSTALS OF TELLURIUM. G.Syrbe.
Ann. Phys. (Leipzig), Folge 7, Vol. 4, No. 1-5, 132-9 (1959).
In German.

Extension along the hexagonal axis leads to a reversible increase of the electrical conductivity and to a reversible decrease of the thermoelectric power. This behaviour can be explained by an energy band model. B.T.M.Willis

537.321

12311. EXPERIMENT IN THERMOELECTRICITY. W.D.Brennan.
Amer. J. Phys., Vol. 27, No. 6, 427 (Sept., 1959).

Fundamental analysis of the division of the Joule heat between the ends of a thermocouple. It is shown that the equations normally obtained to describe the phenonema are correct but are usually based on a fallacious argument. C.A.Hogarth

537.321 : 537.56 : 621.362

12312. THERMOELECTRIC PROPERTIES OF THE PLASMA DIODE. H.W.Lewis and J.R.Reitz.
J. appl. Phys., Vol. 30, No. 9, 1439-45 (Sept., 1959).

The thermoelectric properties of a gas-filled diode containing a high density of positive ions are discussed in some detail. The complete circuit of diode and load is treated as a thermocouple, and expressions for both the Seebeck e.m.f. and thermoelectric conversion efficiency are obtained as a function of cathode and anode temperatures. The interior of the diode is divided, for convenience, into three regions: (1) the cathode sheath, (2) main body of plasma, and (3) the anode sheath. The anode sheath is the region of large temperature gradient; the approximate temperature distribution in the sheath is obtained by solving a greatly simplified heat-conduction equation. The results of this analysis are compared with experiments performed by Grover, Roehling, Salmi and Pidd (Abstr. 9691 of 1959).

537.321

12313. THEORY OF THERMOELECTRIC POWER OF IONIC CRYSTALS. I. E.Haga.
J. Phys. Soc. Japan, Vol. 13, No. 10, 1090-5 (Oct., 1958).

A theory of the thermoelectric power in AgBr is developed, in which the experimental conditions are properly considered. The gradient of the electrochemical potential of silver ions is calculated, since it is related to the quantity measured by the potentiometer, that is, the difference between the Fermi levels at two free ends of lead wires. An expression for the thermoelectric power is derived, which is applicable to AgBr mixed with $CdBr_2$ at arbitrary temperatures. The Peltier and Thomson coefficients in the steady state are independently calculated for this special case, and the result shows that the Kelvin relations are really satisfied in the steady state. Finally, the theory is compared with the experiments of Patrick and Lawson.

537.323 : 536.2

12314. THERMOELECTRIC POWER AND HEAT CONDUCTION OF III-V COMPOUNDS AND THEIR MIXED CRYSTALS. H.Weiss.
Ann. Phys. (Leipzig), Folge 7, Vol. 4, No. 1-5, 121-31 (1959).
In German.

For III-V compounds there is a relation between the thermal conductivity and reciprocal thermal expansion coefficient. Whilst the thermal conductivity of mixed crystals $In(As_yP_{1-y})$ shows a minimum value for y = 0.5, the electron mobility decreases monotonically from InAs to InP. At the same time electron and hole effective masses increase. This suggests that the mean free path of electrons is at least an order of magnitude greater than that for phonons. C.A.Hogart

537.323 : 536.21

12315. ELECTRICAL PROPERTIES OF BISMUTH SELENIDE, Bi_2Se_3. II. THERMOELECTRIC POWER AND THERMAL CONDUCTIVITY. K.Hashimoto.
Mem. Fac. Sci. Kyusyu Univ. B., Vol. 2, No. 5, 187-93 (Dec., 1958)

For Pt I, see Abstr. 1448 (1959). The relationship is examine between the thermoelectric power and the Hall coefficient and electrical conductivity. Thermal conductivity measurements are reported.

537.324 : 539.

12316. SNAP-III — ELECTRICITY FROM RADIONUCLIDES AN THERMOELECTRIC CONVERSION.
M.Barmat, G.M.Anderson and E.W.Bollmeier.
Nucleonics, Vol. 117, No. 5, 166-168, 171, 172, 174 (May, 1959).

A small source containing 1760 curies of Po^{210} is used to heat 54 lead telluride semiconductor thermoelectric junctions. The col junctions radiate heat to the atmosphere. The generator delivers 25 W at an overall efficiency of 5% and weighs 5 lb. R.D.Smi

537.363

317. NEW METHOD OF CONTINUOUS FREE BOUNDARY ECTROPHORESIS. H.C.Mel.
chem. Phys., Vol. 31, No. 2, 559-60 (Aug., 1959).
Describes an apparatus which ensures free-boundary flow and vel stability at high flow-rates during continuous electrophoresis. plications are discussed. G.I.W.Llewelyn

ELECTRIC DISCHARGES

537.521 : 621.387

318. PULSE TECHNIQUE FOR PROBE MEASUREMENTS IN AS DISCHARGES. J.F.Waymouth.
appl. Phys., Vol. 30, No. 9, 1404-12 (Sept., 1959).
A pulse technique for making Langmuir probe measurements in s discharges has been developed. The basic procedure consists operating the probe 40-50 V negative with respect to the discharge, d pulsing it positive at a repetition rate of 60 c/s. The probe rrent—voltage characteristic during the positive-going pulse is esented on an oscilloscope and the resulting trace is photographed. ie phase of the pulse may be varied, so that the method is useful r studying 60 c/s a.c. discharges as well as d.c. discharges. sitive-ion bombardment while the probe is strongly negative tends sputter away contamination and make it possible to keep the probe ean while making measurements within 1 mm of an oxide cathode at 00^0 C, despite rapid evolution of contaminants from the cathode. gether with the small size of the probes that can be used, this rmits meaningful measurements to be made in the negative glow an oxide-cathode low-pressure discharge of the fluorescent-lamp pe. Measurements on such lamps are described which demonstrate e presence of energetic primary electrons from the cathode as ell as secondary electrons in the negative glow.

537.523

319. ELECTRON RECOMBINATION AND NEGATIVE BANDS I AFTERGLOWING, ACTIVE NITROGEN.
.H.Brömer and U.Stille.
ptik, Vol. 15, No. 6, 382-8 (June, 1958). In German.
Recent microwave measurements of the decay of electron density hydrogen plasmas excited by a pulsed discharge indicate that e coefficient of electron recombination for pure nitrogen is several wers of ten lower than the values determined hitherto by analogous ecay measurements in nitrogen. It seems possible to interpret e emission of negative bands of N_2^+, observed in the long-duration uroral afterglow of nitrogen, as excitation of long-lived molecule ns originating from the discharge. This interpretation seems to be upported by recent measurements of the decay of light intensity of e negative bands in the auroral afterglow.

537.523.3 : 541.126

320. THE IGNITION OF PROPANE—AIR MIXTURES IN BRUSH ISCHARGES. E.Heidelberg.
rch. Elektrotech (Berlin), Vol. 44, No. 2, 116-19 (1959).
German.
Discusses ignition characteristics in corona discharges. gnition voltages and currents are given for essentially point—plane eometry as a function of point diameter, using positive and nega- ve points. J.D.Craggs

537.523.3

321. EFFECTS OF AIR FILM ON FORMATION OF LICHTENERG FIGURES. B.Arai.
ct. Rep. Yokohama Nat. Univ. I, 1958, No. 7, 23-8 (Sept).
Describes experiments made with Lichtenberg figures using special camera in which the photographic emulsion was covered ith an insulating oil layer. The effect of varying the oil layer ickness was studied. J.D.Craggs

537.523.4

322. TEMPERATURE OF THE CHANNEL OF THE SPARK ISCHARGE. M.P.Vanyukov and A.A.Mak.
okl. Akad. Nauk SSSR, Vol. 123, No. 6, 1022-4 (Dec. 21, 1958).
Russian.
The method used has been described by Vanyukov, Mak and arazinskaya [Optika i Spektrosk., Vol. 1, No. 5, 642 (1956)]. Temperatures were measured for open discharge in A, Xe, and N, based on the magnitude of the spectral density of channel brightness for wavelengths corresponding to the centres of gravity of the lines, and for various rates at which energy is fed into the discharge channel. F.Lachman

537.525

12323. ON THE ELECTROPHORESIS IN ARGON—MERCURY LOW-PRESSURE DISCHARGES. H.Morgenroth.
Ann. Phys. (Leipzig), Folge 7, Vol. 3, No. 7-8, 373-95 (1959).
In German.
In a d.c. discharge through A and Hg at low pressure both the Hg concentration and the electron temperature vary with the distance from the cathode. Measurements were made on a mixture of A and Hg to show the variation of electron mobility with the concentration of Hg and the temperature of the electrons. Whilst an addition of less than 10^{11} cm^{-3} of Hg to the A discharge does not affect the electron mobility, the latter decreases sharply for a Hg concentration of more than 10^{12} cm^{-3}. The rate of decrease is here larger for the lower electron temperature. Between 6×10^{13} and 5×10^{14} cm^{-3} the mobility of the electrons is only slightly dependent on their temperature. R.Schnurmann

537.525

12324. AFTERGLOW OF PURE AND MIXED GASES. S.Takeda.
Bull. Fac. Engng Yokohama Nat. Univ., Vol. 7, 65-75 (March,1958).
The decay of electron density in a gas discharge was studied by the frequency shift in a microwave cavity method. The effect of adding hydrogen to inert gases was studied. At low pressures, the diffusion coefficients agreed with previous values, but at higher pressures where recombination predominates there were some anomalies. D.Walsh

537.525

12325. INVESTIGATION OF THE MECHANISM OF THE SEPARATION OF INERT GASES IN A DIRECT CURRENT DISCHARGE. S.É.Frish and N.A.Matveeva.
Dokl. Akad. Nauk SSSR, Vol. 122, No. 3, 375-7 (1958). In Russian.
Experiments on the separation of inert gases in binary mixtures of He, Ne and A are described. A constant p.d. of 1.5 kV was maintained between the electrodes of tubes of various lengths (between 25 and 150 cm), with total pressures between 0.5 and 4 mm of Hg, one of the gases being in admixture. The results obtained indicate that the basic process causing separation is the drift of ions. It is known that an admixture of an easily ionizable component leads to a considerable lowering of the degree of ionization of the harder-to-excite component. This explains the possibility of strong separation in the case of small admixtures of easily excitable components. The effect is greater when the difference in ionization is greater (Abstr. 4561 of 1954). J.M.Zarzycki

537.525.4

12326. ON THE RELATIONS BETWEEN THE ELECTRICAL CONSTANTS OF A VACUUM DISCHARGE AND THE SPECTRUM EMITTED BETWEEN THE WAVELENGTHS 1500-800 A.
G.Balloffet and J.Romand.
C.R. Acad. Sci. (Paris), Vol. 248, No. 8, 1145-7 (Feb. 23, 1959).
In French.
Briefly describes optical properties (emission spectrum and continuum etc.) for "gliding sparks" i.e. sparks over surfaces. J.D.Craggs

537.525.4 : 536.45

DETERMINATION OF THE TEMPERATURE OF A SPARK IN VACUUM. See Abstr. 12182

537.525.5 : 621.387

12327. INVESTIGATION OF AN ARC DISCHARGE AT DIFFERENT PRESSURES. I.Pacheva and N.Vasileva.
Izv. Bulg. Akad. Nauk, Vol. 6, 155-62 (1956; publ. 1957).
In Bulgarian, with summary ($\frac{1}{2}$ p.) in German.
Intensities of spectral lines from a d.c. arc were studied over a range of pressures from 4 cm Hg to atmospheric. The observed dependence of the relative intensity of two spectral lines on pressure may be due to changes in the number of atoms present in the arc. It is shown that recombination of free electrons with ions depends on pressure. Z.Krasucki

537.525.5

12328. THE DISTRIBUTION OF NEUTRAL ATOMS IN THE PLASMA OF A DIRECT-CURRENT ARC.
E.I.Nikonova and V.K.Prokof'ev.
Optika i Spektrosk., Vol. 6, No. 2, 253-4 (Feb. 1, 1959). In Russian.

Previous studies [Optika i Spektrosk., Vol. 4, 144 (1958)] were made of the radial distribution of neutral sodium atoms across the mean cross-section of the plasma of a direct-current arc. The present paper extends previous work to a study of the distribution of neutral sodium atoms at various distances from the cathode. Carbon rods of 7 mm diameter were used as electrodes and the distance between them was 9 mm. The anode had a small channel into which a mixture of NaCl and carbon powder was placed. The voltage across the arc was 120 V and currents were 3.5-4.0 A. The sodium atom distribution was deduced from records of anomalous dispersion in a light beam of 1 mm diameter which passed through the central axis of the discharge. The sodium atom concentration was fairly uniform along the discharge axis, except for a maximum (10^{18} cm^{-3}) near the cathode (1.5 mm from it). The distribution of sodium atoms across the arc was quite uniform near the discharge axis but fell away at distances of 4-5 mm away from the axis.
A.Tybulewicz

537.525.72

12329. SOME EXPERIMENTS WITH AN ELECTRODELESS DISCHARGE. J.K.Wright, W.T.Eeles and J.D.Herbert.
Nature (London), Vol. 183, 1665-6 (June 13, 1959).

The imploding shock wave produced in pre-ionized deuterium (pressure 0.1 to 2 mm Hg), contained in a cylindrical perspex pill-box (radius 2.2 or 3.1 cm), by discharging an 8 μF condenser through a single turn coil around the box was studied by means of streak photographs. Measurements of the variation of the axial magnetic field and the influence of a superimposed steady axial magnetic field were also made. A theoretical expression for the variation of the trapped magnetic field with shock radius is given, and used to compute the rapid increase of magnetic Reynold's number with shock speed. The influence of gas pressure on the voltage required to lead to breakdown in the first half-cycle is also discussed. J.Dutton

537.525.8

12330. FACTORS AFFECTING THE SELF-EXCITATION OF LOW-FREQUENCY OSCILLATIONS IN AN ELECTRIC DISCHARGE.
L.Pekárek.
Czech. J. Phys., Vol. 8, No. 1, 32-45 (1958).

A detailed experimental investigation of the formation of striations in low-pressure glow discharge, and the influence of moving striations on the production of low-frequency oscillations. Low-pressure neon discharges in particular were studied and, for example, the effect of circuit parameters on the oscillation frequency was determined. J.D.Craggs

537.525.8

12331. THE TIME DEPENDENCE OF THE TEMPERATURE OF AN ELECTRON OF A LOW PRESSURE DISCHARGE FOR A CHANGE IN THE VOLTAGE OF THE SOURCE. J.Kracík.
Czech. J. Phys., Vol. 8, No. 3, 341-8 (1958).

Refers to two earlier papers on the subject by Granovskii. The present work gives an analytical treatment, for a low pressure glow discharge, of the change in electron temperature in the discharge for a small periodic change in sound voltage. Variations of electron density, field strength and current are also involved.
J.D.Craggs

537.525.8

12332. LOCAL EXCITATION OF THE WAVE OF STRATIFICATION IN THE POSITIVE COLUMN OF AN ELECTRIC DISCHARGE.
L.Pekarek.
Czech. J. Phys., Vol. 8, No. 4, 498-9 (1958).

Continuation of previous work (Abstr. 4645 of 1959) to show experimentally that a wave of stratification can be originated at a point P remote from the cathode in a uniform glow, by perturbing the plasma at P by a short pulse applied to an external electrode there. J.Dutton

537.525.8 : 537.56

12333. NEGATIVE IONS IN THE POSITIVE COLUMN OF THE OXYGEN DISCHARGE. J.B.Thompson.
Proc. Phys. Soc., Vol. 73, Pt 5, 818-21 (May, 1959).

Probe measurements of the negative ion density, in the positive column of low pressure oxygen discharges, were made. The effect of the negative ion population on ambipolar diffusion is discussed and the charge exchange process is briefly treated.
J.D.Cragg

537.525.

12334. LOW-FREQUENCY POSITIVE-COLUMN OSCILLATIONS IN A GLOW DISCHARGE IN GASES. V.Krejčí.
Czech. J. Phys., Vol. 8, No. 1, 46-56 (1958). In Russian, with summary ($\frac{1}{2}$ p.) in English.

537.525.8

12335. THEORY OF THE CURRENT–VOLTAGE CHARACTERISTIC OF THE STATIONARY [STABLE] GLOW DISCHARGE. I. THE LOW-CURRENT GLOW DISCHARGE. H.Neu.
Z. Phys., Vol. 154, No. 4, 423-41 (1959). In German.

The paper deals with various parts of glow discharge, but speci attention is given to the cathode-fall region, ionization therein, etc. Normal cathode falls are treated, with tabulated data, and the significance of the various Townsend coefficients (α and γ) is discussed
J.D.Craggs

537.525.

12336. THEORY OF THE CURRENT–VOLTAGE CHARACTERISTIC OF THE STATIONARY [STABLE] GLOW DISCHARGE. II. THE HEAVY-CURRENT GLOW DISCHARGE. H.Neu.
Z. Phys., Vol. 155, No. 1, 77-100 (1959).

If the current density of a glow discharge is raised to about te times the normal value, the discharge mechanism is changed. The number of ions produced in the cathodic dark space of such a discharge is no longer sufficient to maintain the discharge. The familiar assumption, that the deficit will be compensated by ions or u.v radiation from the negative glow, is opposed by measurements on obstructed discharges. The interpretation of the charge balance of the strong-current discharge is made possible by regarding the production of fast atoms by charge exchange in the dark space, taking into account the additional electron emission at the cathode and the ionizations in the gas caused by such atoms. The same mechanism allows a satisfactory quantitative interpretation of the "Nahdurchschlag". A complete system of equations for the simultaneous description of the low and the heavy-current glow discharge is given.

537.52

12337. DIELECTRIC STRENGTH OF POLYETHYLENE AT HIGH FREQUENCY. S.M.Bragin.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 4, 387-91 (1958). In Russian. English summary: PB 141041T-4, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington D.C., U.S.A.

A study is made of the breakdown strength of polythene disks 3 cm dia. and 0.05 to 0.1 cm thick, and with a small depression on one face after application of high voltages at a high frequency. The resinification which occurs and leads to breakdown seems to be du to chemical changes initiated by ionization processes at regions of gas inclusion. High-frequency breakdown measurements were ma and with spherical electrodes the breakdown voltage is very sensit to surface condition of the specimen. Between disk electrodes the breakdown voltage is 25% less. The dielectric strength is increas by protecting the polythene from the ionizing gas medium, e.g. by immersing in CCl_4 or freon. C.A.Hogart

537.5

12338. ELECTRIC BREAKDOWN OF THICK ICE LAYERS BY PULSES. A.V.Astafurov.
Izv. Akad Nauk SSSR, Ser. fiz., Vol. 22, No. 4, 419-22 (1958). In Russian. English summary: PB 141041T-4, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington D.C., U.S.A.

The dependence of voltage on time of ice 10-15 mm thick is similar to that of thin solid dielectrics. The breakdown voltage increases with thickness somewhat less than proportionally. The velocity of discharge is greater in thick dielectrics than in thin ones and at a positive polarity than at a negative one. A strong luminescence is observed under high voltage. R.C.K

X-RAYS

537.531

2339. POINT SOURCES FOR X-RAYS. J.Auleytner.
cta. phys. Polon., Vol. 16, No. 1-2, 35-47 (1957).

An X-ray tube with adjustable focus of the order of 20 to 70μ was ilt. The electrode beam is collimated by means of an electro-tatic lens. The different focus sizes are obtained by changing the osition of the cathode filament with respect to the grid diaphragms nd by changing the grid potential with respect to that of the cathode.

537.531

2340. X-RAY PRODUCTION WITH LINEAR ACCELERATORS.
.H.MacGregor.
ucleonics, Vol. 17, No. 2, 104-5 (Feb., 1959).

Nucleonics data sheet No. 29. Graphs show the X-ray intensity roduced from a variety of targets by bombardment with electrons energy 2-20 MeV. The effects of target thickness, the angular stribution of the radiation and the spectrum of the X-radiation roduced are included. Additional curves allow shielding thick-esses to be estimated. R.D.Smith

537.531

2341. WATER-COOLED X-RAY TARGET PRODUCES UP TO 10^6 r/hr. C.D.Wagner and V.A.Campanile.
ucleonics, Vol. 17, No. 7, 99 (July, 1959).

Details of a gold target that can absorb a 1 mA beam from a MeV Van de Graaff accelerator without scanning. R.D.Smith

537.531 : 537.56

2342. SOFT X-RAYS FROM A MAGNETICALLY COMPRESSED LASMA IN SCYLLA. K.Boyer, E.M.Little, W.E.Quinn, .A.Sawyer and T.F.Stratton.
hys. Rev. Letters, Vol. 2, No. 7, 279-80 (April 1, 1959).

Observations in the Scylla plasma experiment showed that soft -rays were emitted from the central plasma region of the dis-harge at the same time as the neutrons were emitted, peak emission entred exactly at the peak compression of the current cycle. The iameter of the X-ray source observed along the discharge axis greed with the diameter of the neutron source determined previous-. The energy of the X-rays was measured by absorption in thin oils of Be, Al and Ni. The intensity was determined from the -ray pulse height in a calibrated NaI(Tl) scintillation counter, linear approximation being made for the pulse height v. energy haracteristic at 1 keV quantum energy. The yield and spectral istribution was consistent with bremsstrahlung from a plasma t an electron temperature of 1 keV.

A.E.I. Research Laboratory

537.531

2343. SEARCH FOR ENHANCEMENT OF BREMSSTRAHLUNG RODUCED BY 575 MeV ELECTRONS IN A SINGLE CRYSTAL OF ILICON. W.K.H.Panofsky and A.N.Saxena.
hys. Rev. Letters, Vol. 2, No. 5, 219-20 (March 1, 1959).

An attempt is discussed to measure the enhancement of remsstrahlung when the momentum transfer corresponds to a eciprocal lattice vector in a single crystal of silicon, irradiated y 575 MeV electrons. X-rays were detected by production of ositive pions, of energy defined by magnetic analysis, from a olyethylene target. No significant dependence of X-ray intensity n crystal orientation was found, which is contrary to the calcu-ations of Überall (Abstr. 461 of 1957). No explanation of the iscrepancy has yet been found. A.Ashmore

537.531

2344. EXPERIMENTS ON TOTAL REFLECTION OF SOFT -RAYS. R.Groth.
nn. Phys. (Leipzig), Folge 7, Vol. 2, No. 7-8, 380-6 (1959).
n German.

Experiments on grazing-angle reflection of 9A X-rays from lass, silver and gold are described. Anomalies in reflection from old are attributed to waviness of the surface. A.R.Stokes

537.531 : 535.3

2345. A SURVEY OF OUR PRESENT SOURCES OF INFORMATION N THE CONVERSION CONSTANT, Λ (= λ_g/λ_s) AND THE ABSOLUTE AVELENGTHS OF X-RAY EMISSION LINES. J.W.M.DuMond.
roc. Nat. Acad. Sci. U.S.A., Vol. 45, No. 7, 1052-80 (July, 1959).

The author gives an extensive and detailed review of the absolute determination of X-ray wavelengths using crystals and ruled gratings respectively. Wavelengths of X-ray spectral lines are known relative to each other to an accuracy of a few parts in a million but absolute accuracy is limited to perhaps 20 parts per million. This makes it unprofitable to express X-ray spectral wavelengths in absolute units such as Angstroms. The author suggests possible experiments and procedures for overcoming this difficulty. T.Mulvey

537.531 : 535.331

12346. INVESTIGATION OF THE Kβ-GROUP OF X-RAY SPECTRA OF MANGANESE IN Mn–Ni SYSTEMS. V.A.Kazantsev.
Dokl. Akad. Nauk SSSR, Vól. 123, No. 3, 449-52 (1958). In Russian.

The wavelength of the Kβ emission spectra of manganese was measured for various ratios of Mn to Ni. This is correlated with magnetic properties. T.Mulvey

537.531 : 535.343

12347. INVESTIGATION OF THE $K\beta_5$-BAND AND THE K-ABSORPTION EDGE OF NICKEL METAL AT THE TRANSITION THROUGH THE CURIE POINT. V.A.Kazantsev.
Dokl. Akad. Nauk SSSR, Vol. 123, No. 4, 667-70 (1958). In Russian.

Brief description of measurement of the shift (1.8 eV) of the $K\beta_5$ line as nickel passes through the Curie point. Absorption measurements were also carried out on thin foils which could be heated. T.Mulvey

537.531 : 535.343 : 539.2

12348. AN INVESTIGATION OF THE L_{111}-ABSORPTION SPECTRUM OF CERIUM IN CERIUM–ALUMINIUM ALLOYS.
S.A.Nemnonov and V.V.Klyushin.
Fiz. Metallov. i Metallovedenie, Vol. 6, No. 5, 951-2 (1958).
In Russian.

The melting points of $CeAl_2$ is 1465°C and of $CeAl_4$, 1250°C—both much higher than those of Ce (830°C) or Al (660°C). The major contribution to the increased binding energy of these compounds comes from the 6s and 5d states of Ce. A.F.Brown

537.531 : 535.343

12349. K ABSORPTION EDGE OF SELENIUM.
R.D.Deslattes and H.S.deBen.
Phys. Rev., Vol. 115, No. 1, 71-4 (July 1, 1959).

Use of thin unsupported selenium absorbers permitted observation of significant structure in the K absorption spectrum. Observations of the $K\beta_2$ emission and the fundamental optical absorption of similar samples have been made and used to assist in the interpretation of the K-edge structure. It is suggested that the prominent absorption maximum at the experimentally determined "edge" arises from transitions to an X-ray excitation state or states in the region of the forbidden energy gap. The following general absorption is attributed to transitions to the conduction band. The gap energy required in this interpretation is approximately 4 electron volts, indicating that the lower part of the conduction band contains little p-type symmetry.

537.531 : 535.37

INTENSITY OF FLUORESCENT X-RAY LINES FROM A HOMOGENEOUS BINARY SAMPLE. See Abstr. 12110

537.531 : 539.1.07

IONIZATION CHAMBER FOR X-RAY DIFFRACTION MEASUREMENTS IN THE PRESENCE OF STRONG RADIOACTIVITY. See Abstr. 11308

ELECTRON EMISSION . ELECTRON BEAMS

537.533 : 548.736.1

MODIFICATION CHANGE AND EXO-ELECTRON EMISSION OF CHROMIUM. See Abstr. 11632

537.533 : 541.183

ADSORPTION OF ZIRCONIUM AND BARIUM ON TUNGSTEN AND THE ELECTRON WORK FUNCTION. See Abstr. 11614

537.533

12350. THE EFFECT OF THE INDIVIDUAL FIELD COMPONENTS ON THE ELECTRON EMISSION OF METALS.
G.Ecker and K.G.Müller.
Z. Naturforsch., Vol. 14a, No. 5-6, 511-20 (May-June, 1959). In German.

This investigation considers the field electron emission of metals under the influence of space charges. Usually the field action of the space charge is taken into account by the average field F calculated from the Poisson equation. However, the statistical distribution of the charge carriers causes field fluctuations on the surface of the metal. As the current density j depends exponentially on the field strength F, these fluctuations yield strong deviations from the relation $j = j(\bar{F})$, where $\bar{j}$ is the average current density. Accounting for the individual field component, one finds that in a certain range of space charge density the average current density $\bar{j}$ is increased by several orders of magnitude. In the application this effect proves to be of great interest relative to the existence of the field arc.

537.533 : 621.385.032.213

12351. PRESSED CATHODES OF ALUMINATES AND TUNGSTATES OF BARIUM AND CALCIUM.
A.I.Mel'nikov, A.V.Morozov, B.N.Popov and A.A.Maklakov.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 5, 613-21 (1958).
In Russian. English summary : PB 141041T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

These cathodes consist of a molybdenum cylinder into which is pressed a mixture of an activator, a reducing material and some tungsten powder. The activator is a barium compound; at the operating temperature free barium is formed, and this activates the cathode. Barium—calcium tungstate was found to be a suitable activator, and cathodes were made with a life of over 1000 hours and an emission density of 8 A cm^{-2}. C.Hilsum

537.533 : 537.529 : 621.385.032.213

12352. THE BREAKDOWN OF THIN ALUNDUM-LAYERS.
S.N.Koikov and A.N.Tsikin.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 5, 622-7 (1958). In Russian. English summary : PB 141041T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

A study of the alumina coatings used for insulating heaters in sub-miniature valves, Breakdown is investigated as a function of temperature and applied field, and it is shown that the probability of breakdown increases sharply at temperatures above 1400°K. C.Hilsum

537.533 : 621.385.032.213

12353. NON-STEADY PROCESSES IN HEATERS.
Yu.K.Shalabutov.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 5, 628-39 (1958). In Russian. English summary : PB 141041T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Polarization effects influence the electrical properties of the heater coatings. A criterion is given for the prediction of heater life. C.Hilsum

537.533 : 621.385.032.213

12354. THE CONSTRUCTION OF A LONG-LIFE VIBRATION-PROOF HEATER FOR HIGH-TEMPERATURE CATHODES.
L.A.Timoshin.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 5, 640-1 (1958). In Russian. English summary : PB 141041T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

A mixture of aluminium oxide and beryllium oxide was substituted for the pure aluminium oxide coating normally used. The life of valves using the new coating was 4000 hours. C.Hilsum

537.533 : 621.385.032.213

12355. SOME TECHNOLOGICAL METHODS FOR THE REDUCTION OF CATHODE—HEATER LEAKAGE CURRENTS.
G.Ya.Pivovarov and Yu.A.Semenov.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 5, 642-4 (1958). In Russian. English Summary : PB 141041T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

A high proportion of sub-miniature valve production was rejected due to heater-cathode leakage. The yield was improved by ultrasonic cleaning of the heater to remove traces of nickel on the surface, by using coarser aluminium oxide particles for the coating, and by purifying the aluminium oxide. C.Hilsum

537.53

12356. EXAMINATION OF PHOTOCATHODES BY USING RADIOACTIVE INDICATORS. N.A.Soboleva.
Izv. Akad. Nauk SSSR, Ser. Fiz., Vol. 22, No. 5, 576-9 (1958).
In Russian. English summary: PB 141041T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Preliminary results of an investigation into the fatigue of caesium-oxide—caesium photocathodes, using Cs^{134} as an indicator, are reported. It is concluded that the activation process of the cathode is not dependent on the initial amount of Cs. The distributi of adsorbed Cs on the walls of the experimental tube was determine by sectioning the tube: most of the adsorbed Cs was found to be in the region of the cathode. The quantity of Cs in the cathode itself is constant both after severe fatigue and after heating to 150°C. C.H.B.Mee

537.53

12357. BISMUTH—SILVER—CAESIUM PHOTOCATHODE.
A.A.Mostovskii, O.B.Vorob'eva and K.A.Maiskaya.
Fiz. tverdogo Tela, Vol. 1, No. 4, 643-7 (April, 1959). In Russian.

A comparison of the spectral characteristics, temperature dependence of photoemission for this cathode and one containing only silver and caesium. The photocurrent is also given as a function of temperature. J.M.Houg

537.53

12358. PHOTOELECTRONIC EMISSION OF SOME SEMICONDUCTOR AND METAL CATHODES WITH A DIMINISHED WORK FUNCTION. P.G.Borzyak, V.F.Bibik and O.G.Sarbei.
Izv. Akad. Nauk SSSR, Ser fiz., Vol. 22, No. 5, 566-75 (1958).
In Russian. English summary: PB 141041T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The work function of a cathode may be reduced by depositing a thin layer of BaO on its surface, the reduction being sufficiently large to shift the photoelectric threshold into the visible. Semiconductors such as InSb and Ag_2Te require a concentration of BaO 4 or 5 times greater than a metallic (Ta) cathode to provide a minimum work function. Photoemission results obtained from metallic cathodes with a BaO layer may be successfully fitted to a Fowler plot. C.H.B.M

537.53

12359. ADDITIVITY OF PHOTOELECTRIC CURRENT AND SECONDARY ELECTRON CURRENT. E.Brinkmann and H.Deichs
Z. Phys., Vol. 156, No. 2, 159-62 (1959). In German.

Papers from Ekertowa (Abstr. 1309 of 1957) and Dember [Z. Phys., Vol. 33, 529 (1925)] show contradicting results concerning the additivity of photoelectric current and secondary electron current. It was found, upon investigation, that additivity exists between photoelectric current and secondary electron current for metals in agreement with Ekertowa. The large departures from additivity, observed by Dember, receive reasonable interpretation in terms of an internal photoelectric effect in the oxide layer of his target.

537.533 : 539.1.

NOISE PULSES IN A PHOTOMULTIPLIER. See Abstr. 11312

537.533 : 539.1.

LIGHT RESPONSE OF ALUMINIUM-WALLED G.M. COUNTE See Abstr. 11300

537.5

12360. RANGE OF SLOW SECONDARY ELECTRONS IN A META AND THE CHARACTER OF INELASTICALLY-REFLECTED ELE TRONS IN SECONDARY ELECTRON EMISSION.
I.M.Bronshtein and R.B.Segal'.
Dokl. Akad. Nauk SSSR, Vol. 123, No. 4, 639-42 (1958). In Russia

Describes briefly an experimental investigation of the part played by fast secondary electrons arising from elastic and inelas

llisions (coefficient η) in the production of slow secondary electrons (coefficient δ), where the total emission coefficient is expressed as $\sigma = \delta + \eta$, since it has been shown by others (Abstr. 5968 1958) that a large number of slow secondary electrons may originate from inelastic collisions. A spherical condenser with suppressor grid was used with primary electrons of $E_p = 0.1$ to 3.6 keV. raphs of δ against η for constant values of E_p for thin layers of Bi, g and Be, and graphs of σ against E_p for a Bi layer on Pt and a t layer on Bi surface, are given. The order of the depth of the igin of secondary electrons was also calculated. A primary electron penetrating a metal surface is shown to produce a small number secondary electrons directly, at a depth λ_s of the order of ten omic layers. Penetrating deeper (a few hundred atomic layers) it uses a large number of inelastically scattered electrons to appear, me of which emerge from the surface (η). Others produce slow ectrons (of $E_s < 15$ eV) at depth λ_s, which thus may be called ertiary" electrons. J.M.Zarzycki

537.533

12361. SECONDARY ELECTRON EMISSION FROM MONO-RYSTALS OF ALKALINE-HALIDE COMPOUNDS AT LOW NERGIES OF THE PRIMARY ELECTRONS.
.A.Fridrikhov and G.N.Goryacheva.
:v. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 5, 486-95 (1958).
ı Russian. English summary: PB 141041T-5, obtainable from ffice of Technical Services, U.S. Dept. of Commerce, Washington, .C., U.S.A.

A single pulse method was used for 3.5-31 eV impinging electrons. Secondary electron emission becomes marked when the energy f primary electrons in the long wave limit of the first band corresponds to the optical absorption of crystals. From this energy value awards emission increases rapidly; regions of steepest ascent orrespond to regions of first and second optical absorption maxima. ine structure is due to the periodic field of the crystal lattice. Thus orrelation between optical and electronic absorption exists.
A.E.D.Heylen

537.533

12362. ON SOME PECULIARITIES OF THE RETARDATION URVES OF SECONDARY EMISSION FILM CATHODES.
.N.Lepeshinskaya and T.M.Sukova.
:v. Akad. Nauk SSSR, Ser. geofiz., Vol. 22, No. 5, 528-33 (1958).
ı Russian. English summary: PB 141041T-5, obtainable from ffice of Technical Services, U.S. Dept. of Commerce, Washington, .C., U.S.A.

Under certain conditions secondary electrons may give retarding potential curves in which saturation occurs with the collector at positive potential: these electrons have been termed "electrons ith insufficient energies" by earlier workers. A number of phenomena which could cause the effect, such as the emission of tertiary lectrons from the collector, charging of the target surface and disortion of the field near the target, are discussed. When these factors have been eliminated it is found that there are no anomalies for econdary emission from MgO or BeO on Ni. If, however, MgO is eated on Mg in the residual gas in the apparatus, saturation does ot take place until + 10 V. Further experiments with an activated u—Mg alloy with a surface film of MgO lend weight to a hypothesis volving patches of different work function at the boundary of the gO film and the base. The contact potential difference between ese patches produces internal fields which tend to form a retarding eld outside the target film above the regions of low work function. o compensate these fields a corresponding voltage is required at e collector, producing the apparent anomaly. C.H.B.Mee

537.533 : 534.39

2363. INFLUENCE OF ULTRASOUND ON THE INERTIA OF THE ALTER EFFECT [IN SECONDARY ELECTRON EMISSION] IN LKALI HALIDE DIELECTRICS. V.Kănev.
zv. Bulg. Akad. Nauk, Vol. 6, 181-9 (1956; publ. 1957). In ulgarian, with summary (1½ pp.) in German.

Thin films of KCl show the Malter effect characterized by econdary emission coefficients ~ 10^3, but with time constants such hat no response to modulation frequencies above 120 c/s exists. he experimental work shows that ultrasonic vibrations in the megacycle region improve the frequency response, but reduce the econdary emission by a factor of 10. It is thought that the ultrasound ffects the work function metal/dielectric. K.W.Plessner

537.533 : 621.383.27

12364. A CONTRIBUTION TO THE STUDY OF PHOTOMULTIPLIER TUBES. P.Cachon and A.Sarazin.
J. Phys. Radium, Vol. 19, No. 10, 792-3 (Oct., 1958). In French.

Briefly describes certain characteristics, electrical and spectral etc., of some types of photomultiplier tubes and proceeds to discuss measurements of transit times and variations therein, and geometrical variations of sensitivity. J.D.Craggs

537.533 : 539.12

12365. ANOMALIES IN THE DETERMINATION OF THE SPECIFIC ELECTRONIC CHARGE WITH THE HELP OF A PENCIL BEAM IN NITROGEN. R.Gebauer and A.Franz.
Acta phys. Austriaca, Vol. 12, No. 3, 246-50 (1959). In German.

Describes a simple apparatus, using a uniform magnetic field, for measuring e/m_0 (to ~ 1% accuracy or a little better). A pencil beam of electrons is deflected in a circular path in low pressure nitrogen. Apparently, e/m_0 varies with the magnetic field and this "spurious" effect is to be ascribed to gas effects, etc.
J.D.Craggs

537.533

12366. ON THE PROPERTIES OF THE ELECTRON BEAM IN THE PRESENCE OF AN AXIAL MAGNETIC FIELD OF ARBITRARY STRENGTH. H.Wilhelmsson.
Chalmers Tekn. Högsk. Handl., No. 205, 31 pp. (1958).

Presents unusually general small-signal theory of a.c. disturbances of a circular cross-section beam travelling parallel to a uniform magnetic field in a neutral ionized medium, collisional effects being neglected. Angle-dependent asymmetrical modes are taken into account, as well as drift Lorentz and relativistic terms in the electrodynamic equations. Special results on longitudinal space-charge, TE, TM and magneto-ionic waves are obtained. The case of a circular waveguide filled by the beam is considered. Another specialization gives the magneto-ionic refractive indices.
B.Meltzer

537.533

12367. ELECTRON COOLING BY HEAT EXCHANGE.
R.C.Knechtli and W.Knauer.
J. appl. Phys., Vol. 29, No. 10, 1513-14 (Oct., 1958).

A method is described for cooling beam currents of the order of milliamps. The electron beam is fired into a plasma and the electrons are cooled by collisions with gas molecules. It is necessary that the accelerating field should not cause reheating, and it has proved possible to draw a current through a plasma with a potential difference of 0.1 V over 10 cm. Under these conditions cooling as predicted by theory is obtained and temperatures of 400°C have been achieved. D.Walsh

537.533

12368. HARMONIC CURRENT GROWTH IN VELOCITY-MODULATED ELECTRON BEAMS. T.G.Mihran.
J. appl. Phys., Vol. 30, No. 9, 1346-50 (Sept., 1959).

Harmonic currents accompanying a fundamental space charge wave of current are found to grow with distance even though the peak amplitude of the fundamental current remains relatively constant. This effect was first noted in studying the results of a series of disk-electron calculations. Subsequently, second harmonic growth was found experimentally using a sliding cavity set-up. A physical explanation of this phenomenon is given. The harmonic growth can be interpreted as parametric amplification in which the finite electron beam acts as the nonlinear element, with the fundamental current providing the pump power.

537.533 : 621.385.833

12369. CALCULATION OF ELECTRON-BEAM DIVERGENCE AT MEDIUM GAS PRESSURES. B.H.Wadia.
J. Electronics and Control, Vol. 6, No. 4, 307-20 (April, 1959).

Because of the large number of variables involved, the effect of gas on beam divergence has not thus far been susceptible to analytic solution; however, a numerical approach based on the use of universal curves and step-by-step integration is found to be capable of giving a reasonable estimate of the beam profile in the presence of gas. Three examples of electron beams of various perveances and entrance angles are solved using this method over a range of pressures from perfect vacuum to full neutralization. A study of these cases enables one to give a rational picture of the

behaviour of electron streams in the presence of gas and several interesting conclusions are drawn regarding the position of the minimum, cross-over, and the condition for parallel beam. Indications are that pressures better than 10^{-8} mm Hg are required before one can truly assume perfect vacuum conditions to prevail.

537.533

12370. METHOD FOR CHECKING ENERGY OF ACCELERATED ELECTRONS. V.A.Campanile and C.D.Wagner.
Nucleonics, Vol. 17, No. 7, 74 (July, 1959).

The fraction of the total beam current penetrating an aluminium absorber is measured using two collectors feeding a bridge circuit. The accuracy is ±15 keV when measuring a 3 MeV Van de Graaff beam. R.D.Smith

537.533

12371. NONLAMINAR FLOW IN MAGNETICALLY FOCUSED ELECTRON BEAMS FROM MAGNETICALLY SHIELDED GUNS. T.W.Johnston.
J. appl. Phys., Vol. 30, No. 9, 1456-7 (Sept., 1959).

Photographs of beam shapes, revealed by glow due to residual gas, are compared with the results of Harker's calculations which neglect space-charge forces (Abstr. 636 of 1958) and shown to agree quite well. The development of the typical arrow structure is shown for magnetic fields varying from 0.66 to 3.55 times the Brillouin field. B.Meltzer

537.533 : 621.397.331.21

12372. IMAGE-FORMATION IN THE INTERMEDIATE-IMAGE ICONOSCOPE ON DIMINUTION OF THE ELECTRON-OPTICAL MAGNIFICATION. U.Schmidt.
Nachrichtentechnik, Vol. 9, No. 2, 64-7 (Feb., 1959). In German.

Describes a modification of the anode cylinder and the magnetic focusing system, necessitated by an increase of photocathode size from 8×10.5 to 12×16 mm^2. The design changes were found empirically. B.Meltzer

537.533

12373. ABERRATIONS IN THE ELECTRON OPTICAL DIFFRACTION PATTERN. F.Lenz.
Optik, Vol. 16, No. 8, 457-60 (Aug., 1959). In German.

The aberrations of diffraction patterns produced by axially symmetric lenses can be calculated using methods similar to those used to calculate the aberrations of the ordinary electron optical image. Small deviations of the lens fields from axial symmetry cause two additional first order aberrations: the diffractional distortion and diffractional displacement. The distortion effects an affine deformation of the pattern, e.g. it deforms a circle to an ellipse. The partial diffraction patterns originating from different parts of the specimen are displaced opposite to one another, together with their primary reflex. The vector describing this displacement is connected with the position vector of its origin in the specimen by a linear transformation.

537.533

12374. A REMARK ABOUT A METHOD OF CALCULATING THE MAGNETIC FIELD. P.Gautier.
J. Phys. Radium, Vol. 20, No. 1, 61 (Jan., 1959). In French.

Points out that the method of calculating the magnetic field along a given axis (J. Phys. Radium, Suppl., No. 7, 73A-77A (July, 1957)), in terms of the flux passing through a circle of finite radius about the axis is not restricted to fields of rotational symmetry but is perfectly general. T.Mulvey

537.533

12375. A β-RAY SPECTROMETER OF TOROID-SECTOR TYPE. A.Szalay and D.Berényi.
Acta phys. Hungar., Vol. 10, No. 1, 57-77 (1959).

A β-ray spectrometer has been constructed with sector pole pieces having a shaped boundary and 42 air gaps arranged in a toroidal form. By using all the gaps, the optimal resolution was ~ 3%, while the maximal used solid-angle was ~2.5%. In the case of a sufficiently strong source, however, one or just a few gaps may be used, and, with a suitable adjustment of the baffles, a 0.7% resolution obtained. The apparatus was calibrated by standard conversion lines and several well-known β-ray spectra. The low current consumption and other special advantages of this type of spectrometer are discussed.

537.533

12376. ON THE RESOLUTION OF A β-SPECTROMETER USING A MAGNETIC FIELD GIVING CONSTANT rH. C.Bastard.
C.R. Acad. Sci. (Paris), Vol. 248, No. 23, 3295-7 (June 8, 1959). In French.

Calculation of the trajectories of β-particles in, and the resolution of, a spectrometer using constant rH (r is distance of point from axis of symmetry and H is magnetic field at that point). C.J.Batty

537.533

12377. MULTIPLE BEAM ELECTRON INTERFERENCE AT REGULARLY ARRANGED FINE SLITS.
G.Möllenstedt and C.Jönsson.
Z. Phys., Vol. 155, No. 4, 472-4 (1959). In German.

Three fine slits were prepared by means of a new method of "writing" on glass with an electron probe. The slits were 0.6 μ wide and 100 μ long, and the centre-to-centre spacing was 2.2 μ. When illuminated with an almost parallel electron beam, electron interference fringes were observed analogous to the optical effect first found by Thomas Young, including the secondary maxima. V.E.Cosslett

537.533 : 539.27

INFLUENCE OF INELASTIC SCATTERING ON THE CONTRAS OF SUBSTANCES OF LOW ATOMIC NUMBER IN THE ELECTRON MICROSCOPE. See Abstr. 11599

537.52

12378. NEW METHOD FOR RANGE MEASUREMENTS OF LOW-ENERGY ELECTRONS IN SOLIDS. J.E.Holliday and E.J.Sternglass
J. appl. Phys., Vol. 30, No. 9, 1428-31 (Sept., 1959).

A new method for determining the range of low-energy electro in solids is described and compared with older techniques. In the new method, the material under study is deposited on a thick layer of greatly different electron back-scattering characteristics. Wher the incident electrons have just sufficient energy to penetrate to th support and return to the surface, a marked change in the back-scattered fraction occurs. In this manner, the need for very thin organic supporting films of unknown stopping power is avoided. Range–energy data from 1 to 15 keV for films of aluminium on a gold substrate obtained by this technique are found to agree with th data obtained by the use of cathode luminescence to detect electron penetration. The technique was applied to thin films of gold in the energy region from 2 to 15 keV. It was found that the practical ranges in mg/cm^2 for gold and aluminium were the same below 10 keV, unlike the situation in the MeV region where the effective penetration into Al is about twice that for Au due to the importance of nuclear scattering in a high Z element. Good agreement is foun with the Bohr–Bethe theory for aluminium at all energies and for Au below ~ 10 keV.

ION EMISSION . ION BEAMS

537.5

12379. TEMPERATURE DEPENDENCE OF THE WORK FUNCTI OF SILVER, SODIUM, AND POTASSIUM.
C.R.Crowell and R.A.Armstrong.
Phys. Rev., Vol. 114, No. 6, 1500-6 (June 15, 1959).

Measurements have been made of the temperature dependence the work functions of freshly evaporated films deposited at pressu of the order of 10^{-9} mm Hg. The results for silver (-13.4×10^{-5} V were obtained by a capacitive contact potential method, those for sodium and potassium (-51×10^{-5} and -26×10^{-5} V/deg K, respectively) by the diode retarding-field method. The theoretical outline by Herring and Nichols (Abstr. 5506 of 1949) has been extended to produce quantitative predictions in fair agreement with the experi mental results. Quantum-defect calculations of the internal energ have been used to determine the effect of thermal expansion. Som allowance for anisotropy and dispersion has been included in the c culations of the electrostatic effect of thermal vibrations at consta volume. This effect is the largest contribution to the temperature dependence of the work functions of monovalent metals. The calcu tions point out the importance of the predominantly transverse mo of vibration. The effect of thermal vibration at constant volume o

e chemical potential has also been calculated allowing for aniso-opy and dispersion, and is shown to be small ($\sim -2 \sim 10^{-5}$ V/deg K r monovalent metals). The theoretical predictions (representing e assumed model within an estimated 25%) are -12×10^{-5}, 15×10^{-5}, and -28×10^{-5} V/deg K for silver, sodium and potassium spectively.

537.534 : 548.5

STUDY OF PSEUDOSPIRALS PRODUCED BY FIELD VAPORATION OF METAL CRYSTALS. See Abstr.11622

537.534 : 621.384.623

2380. DUO PLASMATRON ION SOURCE FOR USE IN CCELERATORS.
.D.Moak, H.E.Banta, J.N.Thurston, J.W.Johnson and R.F.King.
ev. sci. Instrum., Vol. 30, No. 8, 694-9 (Aug., 1959).

Evaluations of various sources for accelerator use at proton irrents above 10 mA indicate that a variation of Von Ardenne's uo Plasmatron will give performance superior to that of any other ource presently available. Operating characteristics for various zes of the source were examined for H_1^+, H_2^+, H_3^+, H_1^-, He^+, and e^{++} ions and electrons. Experience with protons in the current ange from 1 to 30 mA indicates that the Duo Plasmatron can deliver to 100 amp/cm^2 of exit aperture area. Current densities such s this cannot be maintained in the accelerator-extractor section ecause of space charge forces, even at the highest gradients ormally available for well-polished electrodes in vacuum; thus it an be said that proton current densities will be space-charge-mited by the accelerator rather than emission-limited by the source. peration for He^+ ions and electrons is similar to proton operation. urrents of 11 μA of H_1^- ions and 5 μA of He^{++} ions were extracted irectly from a source which had been designed for a proton current f several milliamperes. The most striking features of the Duo lasmatron are its remarkably high brilliance, high gas efficiency, ood power economy, and compactness.

537.534

2381. PRODUCTION OF POLARIZED PROTON BEAMS.
.Madansky and G.E.Owen.
hys. Rev. Letters, Vol. 2, No. 5, 209-11 (March 1, 1959).

Results are given of a preliminary experiment designed to roduce an intense beam of metastable hydrogen ions by electron ick-up. A neutral metastable hydrogen atomic beam, produced y passing a 10 keV ion beam through a hydrogen chamber, was uenched by an electrostatic or magnetic field. A second variable lectrostatic or magnetic field was used to provide a quenching egion for detection of the metastable beam by an L_α geiger counter. he observed variation of counting rate with field strength in each osition agreed with that predicted. A pick-up cross-section $0.01\ \pi a^2$ is indicated; the ionization of such a beam will produce 50% polarized proton beam without the introduction of r.f. uenching. A.E.I. Research Laboratory

537.534

2382. OPTICS OF THE DEFLECTION OF A BEAM OF HIGH NERGY CHARGED PARTICLES. J.Pinel.
nn. Radioelect., Vol. 14, 230-49 (July, 1959). In French.

A study of theoretical and practical problems arising in the eflection, analysis and refocusing of a beam of accelerated particles. fter an exposition of the problem an examination is made of certain f the solutions proposed, followed by the methods of calculation stablished for this study, and of the various essential elements: lectromagnets, four-pole lenses. As an example, a description is iven of the calculation of the essential elements of the "250 MeV" tation of the Orsay linear accelerator.

537.534

2383. THE MOTION OF CHARGED PARTICLES IN THE AGNETIC FIELD OF A STRAIGHT [INFINITELY LONG] CURRENT-'ARRYING CONDUCTOR. F.Hertweck.
. Naturforsch., Vol. 14a, No. 1, 47-54 (Jan., 1959). In German.

Using the numerical solutions of the equations of motion, the rift velocity of the particle along the wire is calculated. For small article energies, there is agreement with Alfvén's approximation. he limits of the region to which the particle is confined are calcu-ated for different values of the particle energy and of its angular omentum.

537.534

12384. THE THREE DIMENSIONAL STABILIZATION OF CHARGE CARRIERS IN A [H.F. ELECTRIC] QUADRUPOLE FIELD.
E.Fischer.
Z. Phys., Vol. 156, No. 1, 1-26 (1959). In German.

It is shown that particles of a specific charge e/m are confined by a field with the potential

$$\varphi = c \cdot U(t) \cdot (x^2 + y^2 - 2z^2).$$

The confinement is mass selective. The theoretical predictions are verified by experiments with ions of different masses and with electrons. The mass selection, maximum number of stored charges and their mean lifetime in the field are measured. The influence of a magnetic field on the motion of the charges is investigated.

537.534

12385. SPHERICAL CONDENSERS FREE FROM SPHERICAL ABERRATION. H.Ewald.
Z. Naturforsch., Vol. 14a, No. 7, 680-1 (July, 1959). In German.

Discusses the use of spherical and toroidal condensers in spectrometers. It is shown that a toroidal condenser system can be constructed in which the mean zero potential is part of a sphere thus eliminating spherical aberration, while retaining stigmatic focusing. T.Mulvey

537.534

12386. ELASTIC SCATTERING OF SLOW IONS IN GASES.
E.A.Mason and J.T.Vanderslice.
J. chem. Phys., Vol. 31, No. 3, 594-600 (Sept., 1959).

Differential cross-sections for the elastic scattering of slow ions by neutral atoms or molecules have been calculated by numerical integration of the classical equations of motion. The model used for the ion-neutral potential energy function consists of three terms: an r^{-4} attraction, an r^{-6} attraction, and an r^{-12} repulsion. The attractive terms are theoretically sound, but the repulsive term is empirical. Quantum effects have been ignored, but an approximate formula indicates at what point the classical calculations begin to fail in any particular case. The results should be of most use in the very low energy region where experimentation is difficult.

PARTICLE ACCELERATORS

537.54

12387. FLIP-COIL TARGET POSITIONER FOR USE WITH ACCELERATORS. K.F.Stone and R.J.Force.
Rev. sci. Instrum., Vol. 30, No. 9, 787-8 (Sept., 1959).

A target positioner for use in the accelerating chamber of the Berkeley bevatron is described. This positioner has a rise time of 75 msec and equally fast drive-down. The mechanism has been proved reliable to 10^6 cycles between maintenance periods.

537.54

12388. HIGH-CURRENT, 400 kV COCKCROFT–WALTON ACCELERATOR. W.L.Bronner, K.W.Ehlers, W.W.Eukel, H.S.Gordon, R.C.Marker, F.Voelker and R.W.Fink.
Nucleonics, Vol. 17, No. 1, 94-7 (Jan., 1959).

A 2 mA ion beam was obtained using a cold-cathode discharge in an axial magnetic field. Neutron yields were measured using various targets, including T absorbed on Zr and self-regenerating gold and silver targets. Neutron fluxes up to 2.4×10^9 n/(cm^2 sec) were obtained. R.D.Smith

537.54

12389. A 200 kV COCKROFT–WALTON ACCELERATOR USED FOR NEUTRON PRODUCTION.
M.Paić, K.Prelec, P.Tomaš, M.Varićak and B.Vošicki.
Period. math.-phys. astron (Zagreb), Vol. 12, No. 4, 269-87 (1957). In French.

Describes a 200 kV h.t. set which has been built at Zagreb and is to be used to produce neutrons by the D–D and D–T reactions. The high-voltage is obtained using a voltage doubler circuit in conjunction with a 100 kV transformer. Maximum beam current obtainable is 10 mA but the normal current used is 2 mA; ripple on the high voltage output is 0.1%. Details of a heavy-ice target

which can withstand beam current densities of up to 500 $\mu A/cm^2$ are given. A.E.I. Research Laboratory

537.54

12390. ON TWO EFFECTS LEADING TO CAPTURE OF ELECTRONS IN THE BETATRON MODE OF ACCELERATION.
A.P.Komar and Yu.S.Korobochko.
Dokl. Akad. Nauk SSSR, Vol. 123, No. 4, 643-4 (Dec. 1, 1958).
In Russian.

A semi-quantitative analysis of the effect, on the peripheral electrons of an injected beam, of the electrostatic forces exerted by the remainder of the beam. It is shown that this gives rise to a monotonic variation of the amplitude of the radial oscillations, which may lead to the capture of some peripheral electrons by the walls of the vacuum chamber. The scattering of electrons by the inhomogeneities of the space-charge distribution (after some revolutions the beam will have acquired a lens-shaped cross-section) is considered as a further possible perturbation leading to loss of beam. G.Martelli

537.54 : 621.384.612.12

12391. ON SOME CHARACTERISTICS OF THE OPERATION OF THE R.F. SYSTEM OF A SYNCHROTRON WHEN A LARGE NUMBER OF ELECTRONS IS ACCELERATED PER CYCLE.
L.B.Kaminir and G.N.Orlovskii.
Zh. tekh. Fiz., Vol. 28, No. 11, 2583-6 (1958). In Russian.

The influence of accelerated electrons on the r.f. system is investigated for high-energy synchrotrons. Together with the resistive load created by the electrons on the feeding generator, the reactive load also has to be taken into account. In some cases energy losses due to the excitation of passive resonators by the accelerated electrons can occur. The way to reduce these losses is investigated. G.Martelli

IONIZATION . PLASMA

537.56

12392. RESPONSE OF ELECTROSTATIC PROBES TO IONIZED GAS FLOWS IN A SHOCK TUBE. R.G.Jahn and F.A.Grosse.
Phys. of Fluids, Vol. 2, No. 4, 469-70 (July-Aug., 1959).

Describes certain eccentricities of probe behaviour, thought to be due to internal potential differences in the ionized gas, and affecting the interpretation of probe measurements of charge densities in the gas. J.Hawgood

537.56 : 621.317.723

12393. ON THE USE OF IONIZATION CHAMBERS AS CURRENT SOURCES. D.Blanc, É.Fort, R.Lacoste and J.Lagasse.
C.R. Acad. Sci. (Paris), Vol. 248, No. 21, 2984-6 (May 25, 1959).
In French.

Describes the use of ionization chambers, subject to controlled irradiation, as high resistances in electrometer circuits for the measurement of high resistances etc. The chambers were filled with air or argon at 1 atm pressure. The effective resistances were 5×10^{14} ohms and 10^{15} ohms respectively. Certain operating data are given. J.D.Craggs

537.56 : 537.525.8

NEGATIVE IONS IN THE POSITIVE COLUMN OF THE OXYGEN DISCHARGE. See Abstr. 12333

537.56

12394. SPECIFIC PRIMARY IONIZATION IN MIXTURES OF ALCOHOL AND WATER VAPOURS.
R.Van de Walle and J.Verhaeghe.
C.R. Acad. Sci. (Paris), Vol. 248, No. 23, 3292-4 (June 8, 1959).
In French.

Describes experiments made to measure the specific ionization in ethyl-alcohol–water-vapour mixtures for electrons ($H\rho$ varying from about 1000-6000 gauss cm). The results are of importance in the correction of specific ionization measurements made in elementary gases etc. in cloud chambers. J.D.Craggs

537.56

12395. VARIATION OF APPEARANCE POTENTIALS OF ALKANE FRAGMENT IONS WITH THE REPELLER VOLTAGE OF THE MASS SPECTROMETER ION SOURCE.
L.Friedman, F.A.Long and M.Wolfsberg.
J. chem. Phys., Vol. 31, No. 3, 755-8 (Sept., 1959).

The differences in the mass spectrometric appearance potentials for parent molecule ions and the ion fragments which are formed from the parent by hydrogen abstraction were measured for propane, n-butane, and n-pentane as a function of the repeller voltage in the ion source. With pentane, the potential difference varies from close to zero for no repeller voltage to 1.1 V for 0.5 V repeller voltage or higher. There is a similar but smaller increase of 0.6 V with n-butane, while with propane the changes in appearance potentials are well within the experimental error. Of the various explanations considered, the most likely is that zero repeller voltage leads to relatively longer ion residence times in the source and that, as a result, some low-probability de-excitation processes have time to occur. This implies that appearance potentials which are obtained for this type of process with use of the usual repeller voltages can be considerably in excess of the minimum threshold energies.

537.5

12396. ELECTRON IMPACT STUDY OF NITRIC OXIDE USING A MODIFIED RETARDING POTENTIAL DIFFERENCE METHOD.
G.G.Cloutier and H.I.Schiff.
J. chem. Phys., Vol. 31, No. 3, 793-9 (Sept., 1959).

An electron impact study of NO was made using the retarding potential difference method for producing the effect of a monoenergetic electron beam. In this modification of the method the electron retarding potential is provided by the potential minimum which exists between the anode and cathode of a space-charge limited diode. The ionization potential of NO was found to be 9.25 ± 0.02 eV and the ionization efficiency curve for NO^+ to be nonlinear near the onset. This curvature can be attributed to the difference in the equilibrium internuclear distances of NO and NO^+. Appearance potentials were obtained for the formation of N^+, O^+, and O^- ions from a number of processes. With the exception of O^- ions formed by electron capture, it was not necessary to postulate that any of the ions are formed with excess kinetic energy. The appearance potentials of all the processes are consistent, within experimental error, with a value of 6.50 eV for the dissociation energy of NO. The shape of the resonance capture curve for O^- formation was used to construct part of the potential energy diagra for the NO^- ion.

537.5

12397. TOWNSEND'S FIRST IONIZATION COEFFICIENT IN PURE NITROGEN. A.E D.Heylen.
Nature (London), Vol. 183, 1545-6 (May 30, 1959).

Describes measurements of α/p_0 for 99.998% N_2 for ~ 30 V/cm per mm Hg < E/p_0 < ~ 90 V/cm per mm Hg. Results agree with values of Masch except in the lower range of E/p_0. G.C.William

537.5

12398. THE ATTACHMENT OF SLOW ELECTRONS IN AIR AND OXYGEN. J.B.Thompson.
Proc. Phys. Soc., Vol. 73, Pt 5, 821-2 (May, 1959).

Briefly describes a correction to the interpretation of the electron capture cross-sections in oxygen, measured and discusse by Tozer, Thorburn and Craggs. The agreement between these data and those of Harrison and Geballe is thereby slightly improve J.D.Cragg

537.56 : 539.1

12399. IONIZATION PRODUCED BY ATOMIC COLLISIONS AT keV ENERGIES. II. A.Russek and M.T.Thomas.
Phys. Rev., Vol. 114, No. 6, 1538-40 (June 15, 1959).

The electron evaporation model, presented in Pt I (Abstr. 8846 of 1958), of the collision–ionization process that occurs when atom collide at high energies is extended and improved. In addition, an alternative model of the process is considered. This second mode treats the collision–ionization process as being due to direct knoc outs of the electrons by violent electron–electron collisions. It is found that this model cannot be made to account for the data, there lending additional support to the assumptions inherent in the evapo tion model.

537.5

12400. THE CLUSTERING OF IONS IN IRRADIATED GASES.
J.L.Magee and K.Funabashi.

Radiation Research, Vol. 10, No. 6, 622-35 (June, 1959).

Refers to the Lind theory of ion clustering and its relevance to certain problems of radiation chemistry of gases. The paper gives an outline of the general theory of ion clustering, with some reference to radiation chemistry. J.D.Craggs

537.56

12401. AN INVESTIGATION OF THE ELECTRON COMPONENT OF ELECTRON AVALANCHES. L.Frommhold.
Z. Phys., Vol. 156, No. 2, 144-58 (1959). In German.

The oscilloscopic study of pulses due to the electron component of avalanches in homogeneous fields confirms that the number of electrons increases exponentially with time. By measuring the drift velocity v_- and applying recent measurements of the first Townsend coefficient α, the time constant τ was found to be $1/\alpha v_-$. One obtained the axial diffusion radius of the electron swarm and thus the mean energy of agitation (0.4 to 0.7 eV) and the cross-section for electron impact. Space charge influence becomes apparent with carrier numbers of about 10^7 electrons, attenuating the time rate of further growth of the avalanche. This is in accordance with earlier work. The investigation was made with methane in the range of E/p from 28 to 58 V cm^{-1} $(mm\ Hg)^{-1}$, with pd-values from 50 to 1500 cm (mm Hg), with mean gas amplification from e^{12} to e^{17}, and with gap widths of 2, 3 and 6 cm.

537.56

12402. ON DENSITY AND ISOTROPY OF AN IONIZED GAS IN A MAGNETIC FIELD. E.Aström.
Tellus, Vol. 11, No. 2, 249-52 (May, 1959).

The relation between the density on the surface $|v|$ = constant in the velocity space and the density in the space is treated. The relationship is given by an integral equation. First, the three-dimensional case for homogeneous magnetic field is treated, then a two-dimensional case in a magnetic field the intensity of which varies linearly with the space coordinate to show the dependence on the inhomogeneity in the field.

537.56 : 551.594.12

12403. MICROWAVE CONDUCTIVITY OF SLIGHTLY IONIZED AIR. H.Margenau and D.Stillinger.
J. appl. Phys., Vol. 30, No. 9, 1385-7 (Sept., 1959).

The conductivity of air ionized by injection of electrons at different altitudes is computed with the use of experimentally established collision cross-sections of electrons in oxygen and nitrogen. The results, in the form of graphs, are compared with the usual, simpler formulae based upon the assumptions of (a) a constant collision frequency, and (b) a constant mean free path. The departures are in excess of the experimental error in good conductivity measurements.

537.56

12404. ON THE THEORY OF TRANSPORT PHENOMENA IN DISCHARGES AT HIGH CURRENT DENSITIES. H.Schirmer.
Z. Naturforsch., Vol. 14a, No. 4, 318-23 (April, 1959). In German.

A theory of transport phenomena is developed for the case of a discharge plasma with an appreciable self-magnetic field and acted upon by a longitudinal magnetic field. The formulae are derived for a Lorentz gas. J.D.Craggs

537.56

12405. ON EQUILIBRIUM IONIZATION PRODUCED BY DUST PARTICLES. Yu.S.Sayasov.
Dokl. Akad. Nauk SSSR, Vol. 122, No. 5, 848-51 (1958). In Russian.

Gives a full theoretical analysis of the equilibrium ionization produced by spherical microscopic particles. The general equation obtained, can be used with the help of elliptical θ-functions, for the calculation of the concentration of electrons. Shows how the equation is reduced in limiting cases to: (a) Saha's equation at sufficiently low temperatures; (b) Einbinder's equation (see Abstr. 5436 of 1957; and 4094 of 1958) at sufficiently high temperatures.

J.M.Zarzycki

537.56

12406. DISTURBANCE PHENOMENA IN PROBE MEASUREMENT OF IONIZED GASES. T.Okuda and K.Yamamoto.
J. Phys. Soc. Japan, Vol. 13, No. 10, 1212-23 (Oct., 1958).

There are two types of disturbance, independent of and dependent on probe potentail. The former (inherent) disturbance has three effects which are classified: asymmetrical effect, formation effect of transition region, and the scattering effect. The latter (incidental) depends on either the negative or positive probe. In the negative probe, penetration of ion sheath into surrounding plasma is characteristic. In the positive probe, there is an unexpected change of electron current, as a result of drainage of electrons, which is observed with rise of positive probe voltage. The mechanism of collection of ions and electrons on the probe is also explained in terms of these disturbance effects.

537.56

12407. THE PINCH EFFECT. G.H.A.Cole.
Sci. Progr., Vol. 47, 437-58 (July, 1959).

A general review, with 53 references. There are, for example, sections on current distributions, the effect of longitudinal magnetic fields, the dynamic pinch in the absence of a magnetic field, the snow plough model, the shock wave model, the dynamic pinch, trapped magnetic field and pinch stability. J.D.Craggs

537.56 : 621.387

12408. ELECTROMECHANICAL ENERGY CONVERSIONS IN A CYLINDRICAL PINCH PROCESS. J.L.Neuringer.
I.R.E. Trans Space Electronics and Telemetry, Vol. SET-5, No. 2, 55-6 (June, 1959).

The series circuit associated with the high current discharge (pinch effect) through a cylindrical tube filled with gas is analysed from an energy viewpoint. The electromagnetic and mechanical energies, and their interconversions during the compression of the gas are explicitly displayed and identified. As a consequence of the above analysis, the exact nonlinear circuit equation and appropriate initial conditions are then formulated. This equation, when coupled with the equation for the radial motion of the pinched gas, will yield an exact solution for the electromechanical interaction.

537.56

12409. A NON-THERMAL DIRECT-CURRENT PLASMA HEATING MECHANISM. D.Reagan.
Nature (London), Vol. 183, 102 (Jan. 10, 1959).

Travelling hydromagnetic waves in a plasma contain magnetic potential wells in which electrons can be trapped. Energy fed to these electrons by an applied d.c. electric field will, under suitable conditions, enhance the waves. R.S.Pease

537.56 : 539.12

12410. BREMSSTRAHLUNG FROM DENSE PLASMAS.
H.R.Griem, A.C.Kolb and W.R.Faust.
Phys. Rev. Letters, Vol. 2, No. 7, 281-2 (April 1, 1959).

Shock pre-heated deuterium was compressed in a magnetic mirror with fields rising to 1.25 and 2×10^5 gauss in ~ 5 μsec. A central region of the plasma about 2-3 mm diameter at maximum compression, emits continuous radiation observed in the visible on a streak spectrograph and in the X-ray region between 1.6 and 8 keV photographically through a Be window. From measured absolute intensities, electron temperatures of 5.5 and 8×10^6 °K and electron densities of 4 and 7×10^{16} cm^{-3} are inferred for the above peak fields, respectively. R.F.Pease

537.56 : 537.531

SOFT X-RAYS FROM A MAGNETICALLY COMPRESSED PLASMA IN SCYLLA. See Abstr. 12342

537.56 : 535.388

STRUCTURE OF SPECTRAL LINES FROM PLASMAS. See Abstr. 12021

537.56

12411. HEATING AND CONFINEMENT OF A PLASMA BY A MAGNETIC FIELD OF EXTERNAL ORIGIN AND WITH A SHORT RISE TIME. H.G.Loos.
Phys. Rev. Letters, Vol. 2, No. 7, 282-3 (April 1, 1959).

Calculates in cylindrical geometry, the line density of atoms necessary for a skin depth, thin compared to the tube radius, and necessary for the ion–ion collision time to be short compared to the skin decay time. Values quoted are 2 and 50×10^{14} cm^{-1} for the two cases respectively. R.S.Pease

537.56

12412. EXPERIMENTAL GENERATION OF PLASMA ALFVÈN WAVES. T.K.Allen, W.R.Baker, R.V.Pyle and J.M.Wilcox.
Phys. Rev. Letters, Vol. 2, No. 9, 383-4 (May 1, 1959).

Describes the generation, with controlled condenser discharges,

of Alfvèn waves in hydrogen at a pressure of 0.1 mm Hg. The propagation of the disturbances in the pre-ionized gas was studied.
J.D.Craggs

537.56

12413. ON ACOUSTIC-ELECTRICAL PHENOMENA IN A DEGENERATE ELECTRON–ION PLASMA.
P.S.Zȳryanov and G.G.Talutz.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 145-8 (1959). In Russian.

Electrical phenomena appearing in an electron–ion plasma in which acoustic waves are travelling are considered. The space attenuation coefficient (absorption coefficient) of the waves is computed.

537.56

12414. INVESTIGATION OF A CURRENT-CARRYING RING UNIFORMLY MOVING IN A PLASMA LOCATED IN A MAGNETIC FIELD. L.S.Bogdankevich.
Zh. eksper. teor. Fiz., Vol. 36, No. 3, 835-8 (1959). In Russian.

Energy losses due to Vavilov–Cherenkov radiation are computed for a current-carrying ring uniformly moving in a plasma perpendicular to its plane and parallel to the external magnetic field.

537.56

12415. THE ACCELERATION OF CHARGED PARTICLES IN TRAVELLING OR STANDING ELECTROMAGNETIC WAVES.
G.A.Askar'yan.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 619-21 (1959). In Russian.

This note discusses, without going into great detail, the accelerating effect of electromagnetic waves on a plasma whose particles have a single damped resonance (e.g., plasma oscillations or cyclotron resonance). For travelling waves a formula is given indicating that the accelerating force is inversely proportional to the damping when the electromagnetic wave frequency is near the resonance frequency, but that it is directly proportional when the two frequencies are far apart. For standing waves, a net acceleration can occur only if the resonant frequency varies in space with a wavelength half that of the electromagnetic wavelength; some possible ways of achieving this are mentioned.
O.Penrose

COSMIC RAYS

537.591

12416. THE EARTH'S SIMPLE SHADOW EFFECT ON COSMIC RADIATION. J.E.Kasper.
Nuovo Cimento Suppl., Vol. 11, No. 1, 1-26 (1959).

Calculations are made on the assumption that the earth is spherical and its magnetic field that of a magnetic dipole at its centre. A definition is given of the simple shadow cone, and a set of cones is computed. The method used in computing the trajectories differs from that used by Schremp (Abstr. 3665-6 of 1938), and the new simple shadow cones calculated here differ greatly from those of Schremp's. It is suggested that the old cones are in error.
E.W.Kellermann

537.591

12417. PENUMBRA AND SIMPLE SHADOW CONE OF COSMIC RADIATION. M.Schwartz.
Nuovo Cimento Suppl., Vol. 11, No. 1, 27-59 (1959).

Penumbral bands have been calculated in the vertical direction at 30°, 35°, 41°, 45°, and 50° geomagnetic latitude. The vertical direction results have been used to fit total vertical intensity data, and to determine an integral rigidity spectrum.
E.W.Kellermann

537.591 : 523.165

ANISOTROPIES IN COSMIC RADIATION. See Abstr. 11730

537.591

12418. ENERGY SPECTRA AND NUCLEAR INTERACTIONS OF COSMIC RAY PARTICLES.
N.M.Kocharyan, G.S.Saakyan and Z.A.Kirakosyan.
Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1335-49 (1958).
In Russian.

Results of investigations carried out at an altitude of 3200 m above sea level at the Aragats high altitude laboratory during 1953-56 are presented. The energy distributions of protons and μ-mesons with energies up to 100 BeV were investigated. The measured proton and μ-meson spectra can be approximately represented by the expressions $3.2 \times 10^{-3}(2 + E)^{-2.8}dE$ (for $E > 3$ BeV) and $0.5\,(5 + E)^{-3}dE$ (for $E > 4$ BeV). Data are presented for the cross-sections for inelastic nuclear interactions of high energy π mesons and protons in graphite, copper and lead. The proton and π-meson inelastic nuclear interaction cross-sections σ_a were found to be equal. In graphite, copper and lead respectively the following values were found: σ_a 0.65, 0.75 σ_0 and 0.9 σ_0 where $\sigma_0 = \pi(1.4 \times 10^{-13} A^{1/3})^2$ is the geometrical nuclear cross-section.

537.59

12419. NUCLEAR INTERACTION OF A PROTON OF ABOUT 10^{13} eV PRODUCING AN ELECTRON–PHOTON CASCADE OF 2.4×10^{13} eV.
M.W.Teucher, E.Lohrmann, D.M.Haskin and M.Schein.
Phys. Rev. Letters, Vol. 2, No. 7, 313-15 (April 1, 1959).

Reports event in 22 litres of G5 emulsion flown at 110 000 ft. This appears to be the highest energy proton collision in nuclear emulsion described to date.
E.J.Burg

537.591

12420. ON THE POSSIBILITY OF PREFERENTIAL ACCELERATION OF HEAVY ELEMENTS IN COSMIC RAY SOURCE
A.A.Korchak and S.I.Sȳrovatskii.
Dokl. Akad. Nauk SSSR, Vol. 122, No. 5, 792-4 (Oct. 11, 1958).
In Russian.

In considering the relative abundance of heavy nuclei in the primary cosmic ray radiation, it is shown that the statistical Fermi-Teller mechanism of acceleration can account, under particular conditions, for the preferential acceleration of nuclear fragments or nuclei with $Z \geq 2$. Under the same limiting conditions, the same result can be obtained for other acceleration mechanisms, in particular for the type where the induction effect is produced by an exponentially increasing magnetic field.
G.Martel

537.591

12421. INTENSITY DISTRIBUTION OF HIGH ENERGY PIONS IN THE ATMOSPHERE. A.Subramanian and S.D.Verma.
Nuovo Cimento, Vol. 13, No. 3, 572-90 (Aug. 1, 1959).

The vertical intensity distribution of pions in the atmosphere, in the energy range (10^{10}-10^{13}) eV, is calculated from the energy spectrum of muons at sea level. It is found that, at all depths in the atmosphere, pions should account for only a minor fraction of the intensity of nuclear active particles in this energy range. A comparison of the energy spectrum of pions at production with the primary nucleonic spectrum leads to the result that the average inelasticity in collisions of nucleons with air nuclei, in the energy range (10^{11}-10^{13}) eV, lies between 0.5 and 0.3, if reasonable limits to the multiplicity of mesons produced in such collisions are set. It is pointed out that the generation of pions by pions in the atmosphere may have appreciable effect in the zenith angular dependence of muons underground, and if so, this leads to the result that pions are more efficient in producing pions than nucleons, in collisions with air nuclei.

537.591

12422. ON THE TRANSVERSE MOMENTUM OF SECONDARIES IN COSMIC RAY JETS. E.M.Friedländer.
Nuovo Cimento, Vol. 12, No. 5, 483-7 (June 1, 1959).

A method of estimating primary energies of jets is developed which does not assume highly relativistic velocities of the secondary particles in the centre-of-mass system. This assumption, which underlies the conventional methods of estimating primary energies, is shown to be contradicted by experimental data on the transverse momentum and to lead to results for the primary energies which are too high. Expressions are given which permit comparison of the angular distribution of the shower particles with the predictions of theories of meson production. Results obtained from the analysis of 110 jets are in disagreement with the theories of Heisenberg and Landau, while supporting the Fermi model. The data are shown to fit a $\cos^2$ distribution in the centre-of-mass system, assuming a multienergetic spectrum of the secondaries.
E.G.Michael

537.591

12423. POSSIBLE EXAMPLE OF AN INTERACTION IN EMULSION PRODUCED BY A DEUTERON OF ~ 10^{13} eV. P.K.Aditya.
Nuovo Cimento, Vol. 13, No. 1, 219-23 (July 1, 1959).

Calculations based on observations of high energy neutral stars ggest that, for a stack exposed under 15 g.cm^{-2} of atmosphere, gh energy events ($E > 15$ GeV) are produced by protons, neutrons d deuterons in the ratios 21 : 3 : 1. A possible deuteron event is scribed. E.J.Burge

537.591.15

2424. CLOUD CHAMBER STUDY OF PENETRATING SHOWERS NDERGROUND. S.Higashi, S.Mitani, T.Oshio, H.Shibata, .Watanabe and Y.Watase.
uovo Cimento, Vol. 13, No. 2, 265-83 (July 16, 1959).

A multiplate cloud-chamber containing fifteen lead plates cm thick was used to observe penetrating showers underground. ifteen and twenty-three penetrating showers, having four secondary ıower particles on the average, were obtained during 667.9 hr and 303.1 hr at 50 m w.e. and 250 m w.e., respectively. Special atten- on was paid to distinguish penetrating showers produced by -mesons from those by the nucleonic component, the chamber of .rge width (100 cm) having been set as close to the upper wall in e tunnel as possible. Almost all of the observed showers produced / isolated incident particles are considered as probably produced / μ-mesons (named P-showers phenomenologically), and those by ıe of two or more incident particles as due to the nucleonic com- ɔnent (named S-showers), since the m.f.p. of the nucleonic compon- ıt for nuclear interaction is about 10^{-4} times shorter than that of -mesons. After correcting for the triggering efficiency of the ɔparatus, the ratios of frequencies of S-showers to that of P- ıowers turned out to be 1.1 ± 0.3 and 0.92 ± 0.23 at both depths, hich means that half of the high energy nuclear interactions ıderground is produced by the nucleonic component. The depth ɛpendence of frequencies of P-showers is compared with the rediction by Weizsäcker and Williams' treatment of μ-meson ıteractions. In addition, it has remarkably been observed that -showers have a characteristic different from that of S-showers, e., the average number of heavily ionizing secondaries of P- ıowers is 0.3 per shower, while the value of S-showers is 2.8 per ıower.

537.591.15

2425. OBSERVATIONS OF HIGH ENERGY JETS WITH MULSION CHAMBERS. I. TRANSVERSE MOMENTUM OF THE ⁰-MESON. O.Minakawa, Y.Nishimura, M.Tsuzuki, H.Yamanouchi, .Aizu. H.Hasegawa, Y. Ishii, S.Tokunaga, Y.Fujimoto, S.Hasegawa, .Nishimura, K.Niu, K.Nishikawa, K.Imaeda and M.Kazuno.
uovo Cimento Suppl., Vol. 11, No. 1, 125-53 (1959).

A total of 13 emulsion chambers, consisting of multiple andwiches of nuclear emulsion, carbon and lead (described in an ɔpendix) were flown by balloons at heights of 21-25 km over apan for 6-7 hr in the summer of 1956. An analysis of the trans- erse momentum of 49 π^0-mesons in 16 jets of energy 10^{12}-10^{13} eV s reported, based on measurements of well separated individual ascade showers. The spectrum of the transverse momentum, p to 700 MeV/c, had a maximum at about 350 MeV/c with a width ɔout 200 MeV/c, and is not inconsistent with the earlier Bristol esults. E.J.Burge

537.591.15 : 551.594.51

2426. SOLAR PROTON STREAM FORMS WITH A LABORATORY ODEL. W.H.Bennett.
ev. sci. Instrum., Vol. 30, No. 2, 63-9 (Feb., 1959).

A laboratory tube has been developed which produces scale ıodels of the forms assumed by streams of charged particles in the ɛrth's dipole magnetic field. The forms are unexpectedly intricate ıd complicated, as are also the contacts on the earth's surface. hotographs of some representative streams forms and contacts are resented. The tube has served as an analogue computer for stream ɔrms and contacts and, in addition, has revealed the importance of ıe generation of ring currents of charged particles scattered into ;örmer's periodic orbits. The same techniques can be applied in :udies of streamsforms in high-energy accelerators and in other ɔmplicated kinds of magnetic fields.

537.591.15

2427. ON SHOWERS OF MESONS IN THE FIELD OF LOW NERGIES.
.Bonancini, C.Depietri, G.Lovera and R.P.Fedeli.
icerca sci., Vol. 29, No. 4, 811-14 (April, 1959). In Italian.

Formulae relating the inelasticity of a nucleon—nucleon ɔllision with the energy of the primary, and the number, energy ıd angular spread of the shower particles are quoted and compared to experimental data. Satisfactory agreement is found between observation and a formula developed by the authors for showers of moderate energies produced by singly charged primaries and alpha particles. E.G.Michaelis

537.591.15

12428. A HODOSCOPE INVESTIGATION OF THE PENETRATING COMPONENT OF EXTENSIVE AIR SHOWERS. R.E.Kazarov.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 49-51 (1959). In Russian.

A relation of the type $N_{\mu} \sim E_0^{\varkappa}$ for the flux of μ-mesons possessing energies ≥ 0.41 BeV, and moving at a distance from 0 to 24 m from the axis of extensive air showers, has been investigated. It is shown that, for energies $1.54 \times 10^{14} \leq E_0 \leq 3.14 \times 10^{15}$ eV, the exponent is $\varkappa = 0.42 \pm 0.14$.

537.591.15

12429. FURTHER INVESTIGATION OF EXTENSIVE AIR SHOWERS CONTAINING NUCLEAR ACTIVE PARTICLES.
G.Bozóki, E.Fenyves, T.Sándor and A.Somogyi.
Acta phys. Hungar., Vol. 9, No. 3, 347-51 (1959).

Previous work on extensive penetrating showers (Abstr. 2465 of 1959) has been extended. The rate of electron showers accompanied by a nuclear-active component has been determined as a function of the electron detector size. The density spectrum of the N-component is deduced and is found to follow a power law with exponent $\gamma = 1.33 \pm 0.05$, while the corresponding exponent for the electronic component was 1.34 ± 0.08. The value of the exponent has been determined for various thicknesses of absorber over the shielded counters and for penetrating showers of different multiplicities. γ is found to be independent of these variables. Under varying the distance between electron- and penetrating shower detectors. The decoherence curves are shown to follow a power law with exponent $\beta = 0.15 \pm 0.01$, which is independent of the variations of the experimental conditions. E.G.Michaelis

537.591.15

12430. ON THE AIR SHOWER CORE. S.Hasegawa.
Progr. theor. Phys., Vol. 17, No. 4, 603-5 (April, 1957).

On the assumption that π^0-mesons are produced only along the lines of shower axes and assuming also the lateral distribution of the π^0-mesons, the expected lateral distribution of the soft component at sea level is calculated and found to be almost identical with the Nishimura-Kamata function $f(r, s)$, with $s = 1.2$. If the effective altitude of π^0-meson production is 10 km above sea level then the energy flow will be concentrated with 10^{-4} radian. E.W.Kellermann

537.591.15

12431. INVESTIGATION OF THE CORE OF EXTENSIVE AIR SHOWERS. S.N.Vernov, N.N.Goryunov, G.T.Zatsepin, G.V.Kulikov, Yu.A.Nechin, Z.S.Strugal'skii and G.B.Khristiansen.
Zh. eksper. teor. Fiz., Vol. 36, No. 3, 669-81 (1959). In Russian.

A new method for the individual study of these showers is described. The method is applied to the study of the shower core. Some preliminary experimental data are presented, which indicate the existence of sharp fluctations in the energy flux of the electron–photon and nuclear-active components.

537.591.15

12432. HIGH ENERGY NUCLEAR-ACTIVE COMPONENT IN EXTENSIVE AIR SHOWERS AT SEA LEVEL.
A.T.Abrosimov, V.A.Dmitriev, G.V.Kulikov, E.I.Massal'skii, K.I.Solov'ev and G.B.Khristiansen.
Zh. eksper. teor. Fiz., Vol. 36, No. 3, 751-61 (1959). In Russian.

Data are presented on the number of high energy nuclear-active particles in showers containing a total number of particles between 1×10^4 and 2×10^6, and also on the spatial distribution of the energy flux of the nuclear-active component. It is noted that the energy of the nuclear-active component in individual showers, with an equal number of particles, may widely differ. On the basis of the shape of the spectrum of the nuclear-active particles and the shape of the spatial distribution of the energy flux of the nuclear-active component, some conclusions are drawn regarding the underlying nature of the nuclear-cascade process.

537.591.15 : 539.12

12433. ON THE ELASTICITY IN THE HIGH ENERGY JET EVENTS. J.Iwadare.
Nuovo Cimento, Vol. 12, No. 6, 630-4 (June 16, 1959).

An attempt is made to test various models which have been used to account for the high elasticity of high-energy jet events.

Predictions based on these models are compared with experimental data obtained by the Bristol group. It is shown that the estimated fraction of the total energy carried away by pions is 0.56 ± 0.13 and that the angular distributions of pions and heavier particles are similar. The angular distributions of shower particles in primary and secondary jet events have been compared and show similar features. It is therefore suggested that nucleons do not play the special part in high-energy collisions which is assigned to them by the pre-existing field or the excited-nucleon models, and that Landau's dynamical model is in better agreement with the observations. E.G.Michaelis

537.591.2

12434. PROTON COMPONENT OF THE PRIMARY COSMIC RADIATION. F.B.McDonald and W.R.Webber.
Phys. Rev., Vol. 115, No. 1, 194-205 (July 1, 1959).

The proton component was extensively studied at high altitudes on a series of six Skyhook balloon flights at various latitudes using the Cherenkov-scintillation counter technique. The intensity of primary protons was measured at 4°, 41°, 53°, and 55° geomagnetic latitude. The proton differential energy spectrum was measured directly in the region 250-750 MeV. It is observed that primary alphas and protons have the same form of rigidity spectrum from 1 BV to 17 BV. A series of cutoff rigidities are measured in the vicinity of $\lambda = 53°$ and 55°. The intensity and composition of fast splash albedo is determined at $\lambda = 4°$, 53°, and 55°. Significant time variations are observed between the three high-latitude flights. Differences observed in the intensity and energy spectra of these three flights are discussed and strong restraints are placed on possible modulating mechanisms.

537.591.3

12435. UNDERGROUND μ-MESON SPECTRUM AT A DEPTH OF ABOUT 40 m WATER EQUIVALENT. M.I.Daion and L.I.Potapov.
Zh. eksper. teor. Fiz., Vol. 36, No. 3, 697-706 (1959). In Russian.

A magnetic spectrometer was employed to measure the momentum spectrum of μ-mesons in the range from 2×10^8 to 5×10^{10} eV/c.

537.591.3 : 523.51

PRODUCTS OF COSMIC RADIATION IN THE SIKHOTE–ALIN' METEORITE. See Abstr. 11732

537.591.3

12436. MEASUREMENTS OF THE MASS OF COSMIC-RAY PARTICLES UNDERGROUND. M.I.Daion and L.I.Potapov.
Zh. eksper. teor. Fiz., Vol. 36, No. 3, 921-3 (1959). In Russian.

In a depth, equivalent to 40 m of water, the mass-spectrum of the cosmic radiation has been determined by using a magnetic spectrometer. P.Roman

537.591.5

12437. THE ONSET TIMES OF FORBUSH-TYPE COSMIC RAY INTENSITY DECREASES.
A.G.Fenton, K.G.McCracken, D.C.Rose and B.G.Wilson.
Canad. J. Phys., Vol. 37, No. 9, 970-82 (Sept., 1959).

The onset times of a number of Forbush-type decreases observed at four widely spaced stations are compared, and it is shown that appreciable differences occur. The stations selected were Hobart, Mawson, Ottawa, and Sulphur Mountain. It was found that a consistent pattern is obtained for the events studied when the onset times are plotted as a function of the direction of maximum sensitivity of the recorders relative to the earth–sun line. This is interpreted as being due to a directional anisotropy that exists in the mechanism producing the decreases, at least in the early stages. The depression occurs first for particles arriving from directions between 30° and 120° west of the earth–sun line. The relation between these observations and geomagnetic disturbances and the quiet-day daily variation is discussed.

537.591.5

12438. A LUNAR INTENSITY VARIATION OF THE COSMIC RADIATION AND ITS ORIGIN. E.Bagge and O.Binder.
Naturwissenschaften, Vol. 46, No. 13, 424 (1959). In German.

Measurements of the cosmic-ray intensity have been carrier out with an IGY coincidence arrangement, containing 10 cm of lead between counters 70 cm apart. For both uncorrected data and those reduced to uniform barometric pressure a lunar variation of 0.12% of the total intensity has been observed. Its minimum and maximum occur respectively 3-5 hours and 17-20 hours after culmination. The intensity variation is too large to be accounted for by a pure shadow effect; it can be interpreted as evidence for a lunar magnetic field. E.G.Michaelis

537.591.8

12439. INVESTIGATIONS ON HEAVY NUCLEI IN PRIMARY COSMIC RADIATION. W.Püschel.
Z. Naturforsch., Vol. 13a, No. 10. 801-8 (Oct., 1958). In German.

Fragmentation probabilities and interaction mean free paths for the interaction of heavy nuclei ($Z > 2$) with target nuclei of emulsions (Ilford G 5) have been obtained. The experiment was carried out in Northern Italy, at a geomagnetic latitude to 46° N. The values are in good agreement with those reported previously by other authors. Values are derived for the fragmentation probabilities in air using the geometrical model introduced by Noon and Kaplon (Abstr. 2851 of 1955). Assigning both to the incident particle and to the target nuclei a radius $R = R_0 \cdot A^{1/3}$, one obtains an effective nuclear radius $R_0 = 1.2 \times 10^{-13}$ cm. Using the present values for the fragmentation probabilities instead of the lower values found in an experiment by Kaplon et al. (1952), their ratio for the fluxes of L-nuclei to M-nuclei at the top of the atmosphere is increased from 0.46 to about 0.80.

537.591.8

12440. INVESTIGATION OF THE NATURE AND SPECTRA OF PARTICLES PRODUCED BY HIGH-ENERGY NUCLEONS.
A.I.Alikhanov, G.P.Eliseev, V.Sh.Kamalyan, V.A.Lyubimov, B.N.Moiseev and A.V.Khrimyan.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 404-10 (1959). In Russian.

The nature and momentum spectra of secondary particles created in lead by high energy cosmic-ray particles were investigated at an altitude of 3250 m above sea level with aid of a magnetic mass spectrometer and multilayer proportional counter.

MAGNETISM

MAGNETIC RESONANCES

538.08

12441. THE MEASUREMENT OF WEAK MAGNETIC FIELDS BY ELECTRON RESONANCE METHODS. A.K.Chirkov.
Pribory i Tekh. Eksper., 1959, No. 2, 36-8 (March-April).
In Russian.

Describes the use and advantages of organic radicals α, α-diphenyl-β-picryl-hydroxyl and α-(n-chlorphenly)-α-phenyl-β-picryl-hydroxyl for resonance measurements of fields down to about 3 Oe, and of solutions of sodium and potassium in liquid ammonia for fields of 0.4 - 3 Oe. A modified form of the magnetometer described in Pribory i Tekh. Eksper., 1957, No. 3, 57, was used. The measurement error is 1 - 0.1%. D.E.Brown

538.08

12442. SMALL MAGNETIC FIELD MAPPING PROBES OF THIN SEMICONDUCTING FILMS. J.W.Buttrey.
Rev. sci. Instrum., Vol. 30, No. 9, 815-17 (Sept., 1959).

The Hall effect in thin semiconducting films has been employed to produce a magnetic field mapping probe of very small active area Germanium probes having active areas of approximately 10 μ^2 were found to have a sensitivity of approximately 100 Oe. Results obtained on thin InSb films indicate small area probes of this material should be sensitive to fields smaller than 5 Oe.

538.1

12443. A SYSTEM OF MAGNETIC MOMENTS IN A WEAK VARIABLE MAGNETIC FIELD. G.V.Skrotskiĭ and A.A.Kokin.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 169-75 (1959). In Russian.

A system of magnetic moments is studied which possesses electric exchange and weak magnetic dipole–dipole interactions and is located in an external magnetic field $H_0 + h(t)$. The equation of motion of the magnetization vector is derived with an accuracy to second order terms in perturbation theory for weak variable fields, $h(t) \ll H_0$. The limits of applicability of the equations obtained are discussed.

538.2 : 537.311.3

12444. MAGNETIC SUSCEPTIBILITY OF SEMICONDUCTORS. G.A.Busch.
Semiconductors and phosphors (see Abstr. 9597 of 1959). pp. 158-7

German.

The article provides a review of magnetic susceptibility data for number of semiconductors. A brief summary of the underlying eoretical considerations, as far as these have been developed to ta, is also given. Stress is laid on the separation of contributions the susceptibility of the crystal lattice and the quasi-free charge rriers. Results are given for the susceptibility of single crystals germanium into which lattice defects have been induced by heat eatment and by plastic deformation. These results indicate that e increase in diamagnetic susceptibility at low temperatures can- t yet be explained satisfactorily. A brief appraisal is given of the portance of susceptibility data as against those which depend upon ectrical transport phenomena. R.Parker

538.2 : 539.19

.445. DIAMAGNETIC SUSCEPTIBILITY OF POSITION ISOMERS. Guha and S.Basu.
aturwissenschaften, Vol. 46, No. 9, 317 (1959).

The anisotropy ratios for disubstituted benzenes are calculated an approximate LCAO method for ortho, meta, and para positions. he calculated values are in the right sequence but too small.
J.Hawgood

538.2

:446. MAGNETIC INVESTIGATIONS OF SPIN-FREE COBALTOUS OMPLEXES. I. TETRAHALO COBALT (II) IONS.
.H.Holm and F.A.Cotton.
. chem. Phys., Vol. 31, No. 3, 788-92 (Sept., 1959).

The magnetic susceptibilities of six spin-free tetrahalo com- lexes of bivalent cobalt, CoX_4^{-2} (X = Cl^-, Br^-, I^-), were investigated ver a temperature range and found to exhibit satisfactory depend- nce on the Curie—Weiss law. The magnetic moments were found to e in the order predicted by crystal field theory, viz., $I^- > Br^- > Cl^-$, hereas previously reported moments for these ions are in the everse direction. The origin of this trend is briefly discussed. vidence obtained from the magnetic measurements is offered in upport of the assignments by Ballhausen and Jørgensen and by rgel of the crystal field bands in $CoCl_4^{-2}$.

538.2 : 532.7

MAGNETIC SUSCEPTIBILITY OF AlSb, GaSb AND InSb IN IQUID STATE. See Abstr. 11896

538.2

2447. CONTRIBUTION TO A PHENOMENOLOGICAL THEORY OF INETIC PROCESSES IN FERROMAGNETIC DIELECTRICS. II. NTERACTION BETWEEN SPIN WAVES AND PHONONS.
M.I.Kaganov and V.M.Tsukernik.
h. eksper. teor. Fiz., Vol. 36, No. 1, 224-32 (1959). In Russian.

For Pt I see Abstr. 1579 (1959). The interaction between spin nd phonons in considered. The time of establishment of equilibrium etween the phonons and spin waves is calculated.

538.2

2448. THE INFLUENCE OF DIFFERENT PARAMETERS ON THE EVERSAL TIME OF FERROMAGNETIC CORES.
.Lagasse and C.Durante.
.R. Acad. Sci. (Paris), Vol. 248, No. 25, 3539-40 (June 22, 1959).
n French.

Extends previous work (Abstr. 11206 of 1959). Discusses the nfluence of the number of turns of the surrounding coil, the nature f the core and the circuit resistance on the reversal time.
D.J.Oliver

538.2

2449. MAGNETIC FIELD INDUCED ANISOTROPY IN ELECTRO- YTICALLY PREPARED NICKEL FILMS. O.Stemme and W.Andrä.
Naturwissenschaften, Vol. 46, No. 10, 352-3 (1959). In German.

Anisotropy constants from 2.0×10^3 to 4.0×10^3 erg cm^{-3} with asy direction of magnetization in the direction of the field applied luring preparation, are reported for 500-10 000 A nickel films.
A.J.Manuel

538.2

2450. THE COUPLING OF BARKHAUSEN JUMPS RESULTING ROM MAGNETIC AFTER-EFFECT. H.Bittel and I.Westerboer.
nn. Phys (Leipzig), Folge 7, Vol. 4, No. 1-5, 203-15 (1959).
n German.

An experimental method is described whereby a temporal relationship between Barkhausen impulses may be determined. The method involves the recording of impulses on recording tape. The analysis of impulses accompanying the magnetization process reveals strong mutual coupling which causes the appearance of individual groups of impulses. The number of impulses in these groups and their separation is approximately independent of the rate of change of the applied field. The groups are interpreted as after-effects.
R.Parker

538.2

12451. MAGNETIC STRUCTURE OF NICKEL MANGANITE.
B.Boucher.
C.R. Acad. Sci. (Paris), Vol. 249, No. 4, 514-16 (July 27, 1959).
In French.

$NiMn_2O_4$ has a f.c.c. inverse spinel structure; at 4.2° K the neutron diffraction spectrum exhibits magnetic diffractions, which may be interpreted in terms of pyramidal or triangular spin couplings.
E.P.Wohlfarth

538.2

12452. POWDER PATTERNS ON MONOCRYSTALS OF $BaFe_{12}O_{19}$.
R.Łappa.
Prace Inst. Tele-i Radiotech., Vol. 3, No. 1(7), 101-6 (1959). In Polish.

The domain structure of Ba ferrite platelets was studied. On natural surfaces (0001), the Bloch walls were observed as continuous wavy lines, running across the whole surface in no preferred direction. On polished surfaces parallel to {0001}, 180° domain boundaries were found, which confirm the uniaxial character of the crystals. These walls were displaced by the application of an external magnetic field.

538.2

12453. MAGNETIC POWDER PATTERNS AT HIGHER TEMPERATURES. W.Andrä.
Ann. Phys. (Leipzig), Folge 7, Vol. 3, No. 5-6, 334-9 (1959).
In German.

Reports results of investigations on polycrystalline cobalt using a colloidal suspension in oil and covering a temperature range up to 380°C; the patterns change as expected near the isotropy point.
E.P.Wohlfarth

538.2

12454. STUDY OF MAGNETIC OXIDES BY CATHODE RAYS.
S.Yamaguchi.
J. Electrochem. Soc., Vol. 106, No. 3, 268-9 (March, 1959).

The magnetic fields in two powdered ferromagnetic oxides, (1) NiO and (2) Fe_2O_3:NiO:ZnO = 50:15:35 by weight, were estimated from the displacement of electron diffraction patterns. The fields were (1) 11.4 G, (2) 5.53 G.
D.M.Edwards

538.2

12455. A NEW LAW IN THE FIELD OF PLASTIC DEFORMATION.
K.Wotruba.
Acta. phys. Polon., Vol. 16, No. 1-2, 165-7 (1957). In German.

Reports results of measurements of the initial permeability μ_0 and coercive force H_C of nickel and mumetal strips as dependent on the degree of plastic deformation, and observes a linear relation between $1/\mu_0$ and H_C.
E.P.Wohlfarth

538.2

12456. ON DESACCOMODATION EFFECT IN NICKEL.
J.Morkowski.
Acta phys. Polon., Vol. 18, No. 1, 75-9 (1959).

Reports results of measurements of the time decrease of the reversible permeability of nickel wires after the application of elastic stresses and after the demagnetization of the specimens under tension; the last effect is strongly dependent on temperature.
E.P.Wohlfarth

538.2

12457. FORCED MAGNETOSTRICTION OF NICKEL. R.C.Hall.
J. appl. Phys., Vol. 30, No. 9, 1459-60 (Sept., 1959).

Reports $\partial\omega/\partial H = 3 \times 10^{-10}$, $h_1' = -0.5 \times 10^{-10}$, $h_2' = 0.6 \times 10^{-10}$ Oe^{-1}.
E.P.Wohlfarth

538.2

12458. THE SATURATION MAGNETIZATION OF NICKEL—COPPER ALLOYS AT LOW TEMPERATURES.
E.I.Kondorskii, V.E.Rode and U.Gofman (Hoffmann).

Zh. eksper. teor. Fiz., Vol. 35, No. 2(8), 549-50 (Aug., 1958). In Russian. English translation in: Soviet Physics—JETP (New York), Vol. 35(8), 380-81 (Feb., 1959).

The $T^{3/2}$ law was verified for alloys with copper contents 0-50% from measurements at 4°, 20°, 77°, and 286° K; the effective exchange integral was found to be almost independent of composition

E.P.Wohlfarth

538.2 : 621.318.12

12459. UNIFORM ROTATIONAL FLUX REVERSAL OF FERRITE TOROIDS. E.M.Gyorgy and F.B.Hagedorn.
J. appl. Phys., Vol. 30, No. 9, 1368-75 (Sept., 1959).

A model is presented for the high-speed uniform rotational flux reversal of ferrite toroids. The magnetization is uniform in the sense that the components of magnetization in a cylindrical coordinate system are independent of position. Analysis of the model, to a very good approximation, leads to results identical with those obtained from uniform rotation in isotropic thin films. The minimum switching coefficient predicted by this model is 0.005 Oe μsec. Experimental confirmation of a high speed switching mode in ferrite toroids is given. A toroid with a wire loop embedded in it was used to induce the proposed flux configuration. The switching coefficient and the extrapolated threshold field associated with the high speed mode have been found to decrease with increasing temperature.

538.2

12460. MISADJUSTMENT OF THE PERMEABILITY OF NICKEL–ZINC FERRITES. A.Marais and T.Merceron.
C.R. Acad. Sci. (Paris), Vol. 248, No. 21, 2976-8 (May 25, 1959). In French.

The permeability μ' of a demagnetized specimen decreases with time. The misadjustment $\Delta\mu'/\mu'$ and the loss tangent both show peaks at various temperatures. The results are dependent on the firing temperature of the ferrite and are modified by small replacements of Zn by Co. Two mechanisms appear to be involved: electronic exchange between ferrous and ferric ions, and diffusion of vacancies at ferric ion sites.

R.C.Kell

538.2

12461. CONTRIBUTION TO THE STUDY OF THE PROPERTIES OF ANISOTROPIC FERROMAGNETIC MEDIA IN THE CENTIMETRE WAVE REGION. G.G.Robbrecht.
Verhandl. K. Vlaamse Acad. Wetensch., No. 58, 102 pp. (1958). In Flemish, with summary (2 pp.) in English.

Reports results of measurements of the components of the permeability tensor of Ferroxcube specimens at 1.25 cm above and below magnetic saturation.

E.P.Wohlfarth

538.2 : 539.14

12462. NUCLEAR ORIENTATION OF COBALT-60 IN ANTIFERROMAGNETIC $Co(NH_4)_2(SO_4)_2.6H_2O$.
J.M.Daniels and M.A.R.LeBlanc.
Canad. J. Phys., Vol. 37, No. 1, 82-3 (Jan., 1959).

A single crystal of cobaltammonium sulphate doped with 5μC of Co^{60} was cooled to 0.05° K in contact with potassium chromium alum by adiabatic demagnetization. γ-ray anisotropies of up to 5½% were measured. Details of the experimental arrangement are given.

J.M.Baker

538.2

12463. THERMO-REMANENT MAGNETISM IN THE SYSTEMS La_2O_3-Fe_2O_3 AND Nd_2O_3-Fe_2O_3. H.Watanabe.
J. Phys. Soc. Japan, Vol. 14, No. 4, 511-16 (April, 1959).

$LaFeO_3$, which is reported to be antiferromagnetic at room-temperature, has, however, a small amount of remanent magnetization. By measuring the hysteresis loops of a sample before and after a thermomagnetic treatment, it is found that the hysteresis loop is shifted along the magnetization axis, especially for specimens cooled in a magnetic field below the magnetic transition temperature, ~ 450° C. The phenomenon can well be intrepreted as a sort of thermoremanent magnetization. A similar phenomenon was also found for $NdFeO_3$.

538.2

12464. NEW APPROACH TO THE THEORY OF SUPEREXCHANGE INTERACTIONS. P.W.Anderson.
Phys. Rev., Vol. 115, No. 1, 2-13 (July 1, 1959).

The theory of indirect exchange in poor conductors is examined from a new viewpoint in which the d (or f) shell electrons are placed in wave-functions assumed to be exact solutions of the problem of a single d-electron in the presence of the full diamagnetic lattice. Inclusion of d-electron interactions leads to three spin-dependent effects which, in the usual order of their sizes, can be called: super exchange per se, which is always antiferromagnetic; direct exchange always ferromagnetic; and an indirect polarization effect analogous t nuclear indirect exchange. Superexchange itself is shown to be closely related to the poor conductivity, in agreement with experiment. By means of crystal field theory the parameters determining superexchange can be estimated, and in favourable cases (NiO, $LaFeO_3$) the exchange integrals can be evaluated with accuracy of several tens of percent. Qualitative understanding of the whole picture of exchange in iron group oxides and fluorides follows from these ideas.

538.2

12465. ANTIFERROMAGNETIC STRUCTURES OF MnS_2, $MnSe_2$, and $MnTe_2$. J.M.Hastings, N.Elliott and L.M.Corliss.
Phys. Rev. Vol. 115, No. 1, 13-17 (July 1, 1959).

The antiferromagnetic structures have been obtained by neutron diffraction. The disulfide exhibits ordering of the "third" kind, the ditelluride, ordering of the "first" kind, and the diselenide, an arrangement which is intermediate between the two. The structures are discussed from the viewpoint of indirect exchange. Magnetic susceptibilities, obtained by the Gouy method, are reported for all three compounds.

538.27

12466. ON THE THEORY OF ELECTRON PARAMAGNETIC RESONANCE IN ELECTROLYTE SOLUTIONS. A.A.Kokin.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 508-11 (1959). In Russian.

The transverse and longitudinal relaxation times and the correction to the gyromagnetic ratio are calculated for electron paramagnetic resonance without account of the hyperfine structure.

538.27 : 538.565 : 621.317.61

EXPERIMENTAL PROCEDURE FOR THE DETERMINATION OF CAVITY PARAMETERS. See Abstr. 11284

538.27 : 535.56

EFFECT OF ELECTRON PARAMAGNETIC RESONANCE ON THE OPTICAL FARADAY EFFECT AT LOW TEMPERATURES. See Abstr.12157

538.2

12467. MOTIONAL EFFECTS IN FREE RADICAL SPIN RESONANCE. D.J.E.Ingram, M.Fujimoto and M.C.Saxena.
Arch. Sci. (Geneva), Vol. 12, Special No., 185-94 (1959).

1959 Maxwell-Ampere Conference paper (see Abstr.11542 of 1959). Examples of motional effects in free radical spin resonance spectra due to self diffusion and due to internal molecular reorientation, particularly of methyl groups. Applications to kinetic studies are discussed.

J.G.Powle

538.27

12468. ELECTRON PARAMAGNETIC RESONANCE IN $SrTiO_3$.
W.I.Dobrov, R.F.Vieth and M.E.Browne.
Phys Rev., Vol. 115, No. 1, 79-80 (July 1, 1959).

The intensities of paramagnetic resonance lines in $SrTiO_3$ have been correlated to the iron concentrations. Evidence for attributing the origin of the resonance of titanates to iron impurities (Fe^{3+}) rather than to the domain structure was obtained. In $SrTiO_3$, resonance experiments over the temperature range 300° K to 1.9° K show a slow continuous increase of the tetragonal component of the crystalline field down to the ferroelectric region. From intensity considerations the absolute signs of the crystalline splitting parameters have been determined.

538.2

12469. PARAMAGNETIC RESONANCE OF CHROMIUM IN A SINGLE CRYSTAL OF RUTILE.
J.Sierro, K.A.Muller and R.Lacroix.
Arch. Sci. (Geneva), Vol. 12, No. 1, 122-3 (1959). In French.

The resonance of Cr^{+++} ions substituted for titanium ions was observed at 3 cm wavelength. Preliminary values for the parameters occurring in the spin Hamiltonian are given.

E.F.W.Seymou

538.27

170. PRESSURE DEPENDENCE OF THE PARAMAGNETIC SONANCE SPECTRA OF TWO DILUTE CHROMIUM SALTS. M.Walsh, Jr.
ys. Rev., Vol. 114, No. 6, 1485-90 (June 15, 1959).

The pressure dependences of the spin-Hamiltonian parameters trivalent chromium in ammonium aluminium alum and potassium balticyanide have been measured up to 10 000 kg/cm^2 near room nperature. In the case of the alum, runs have been made at 0, 24 d 50°C. The g-value remains unchanged while the crystalline field litting, δ, increases by ~ 30%, $(\partial\delta/\partial P)_T$ decreasing with rising nperature and pressure. Using an empirically determined equa- n of state the crystalline field splitting variations are converted isothermal volume and explicit temperature dependences. These are scussed in terms of static and dynamic crystalline fields but are t satisfactorily explained. This failure is attributed to inhomo- neous internal deformation of the unit cell as a function of stress d temperature. A room temperature run on the covalent chromicy- ide shows the g-value as well as the principal splitting parameter, to be nonmonotonic functions of pressure. The rhombic splitting rameter, E, increases quadratically with pressure. Since no empt was made to determine the crystalline equation of state the sonance data are only qualitatively discussed. It is difficult to concile the results with the equivalent crystalline field model of e chromicyanide complex.

538.27

471. PARAMAGNETIC RESONANCE SHOWS RADIATION FFECTS. H.C.Box and H.G.Freund.
ıcleonics, Vol. 17, No. 1, 66, 68, 70, 73, 74, 76 (Jan., 1959).

Resonance spectra were measured for a number of amino-acids d peptides after irradiation by X-rays. Peaks are detected show- g the presence of free radicals. The G-values for their formation e listed, some being unexpectedly high. Fine structure of the sonances due to Fermi interactions or to dipole–dipole inter- tions, between the odd electron and neighbouring nuclei were tected. By measurement of the shape and number of peaks, infor- ation on the structure of the free radicals produced can be deduced.
R.D.Smith

538.27 : 534.39

472. EFFECTS OF 9.2 kMc/s ULTRASONICS ON ELECTRON PIN RESONANCES IN QUARTZ.
.H.Jacobsen, N.S.Shiren and E.B.Tucker.
hys. Rev. Letters, Vol. 3, No. 2, 81-3 (July 15, 1959).

The resonances of manganese impurities or of radiation-induced entres at one end of a quartz rod were observed while ultrasonic ibrations at frequencies near the spin resonance frequency were ıtroduced at the other end. The spin resonance absorption was educed, and the power required for saturation increased, for ultra- onic frequencies within the resonance line-width for the manganese npurities, but extending over 500 Mc/s on either side of the spin esonance frequency for the radiation-induced centres.
E.F.W.Seymour

538.27

473. SILVERED RUBY MASER CAVITY. L.G.Cross.
appl. Phys., Vol. 30, No. 9, 1459 (Sept., 1959).

The technique adopted for silvering ruby specimens to form ompletely filled maser cavities is described. This has many ad- ıntages over machined cavity construction, viz., improved elec- ical performance resulting in higher Q, and ease and simplicity construction. In addition the system is mechanically stable.
S.A.Ahern

538.27

2474. SYNTHETIC RUBY AS A SECONDARY STANDARD FOR HE MEASUREMENT OF INTENSITIES IN ELECTRON PARA- AGNETIC RESONANCE. L.S.Singer.
. appl. Phys., Vol. 30, No. 9, 1463-4 (Sept., 1959).

Difficulties associated with the use of standard intensity samples re the proximity of the standard resonance line to the free electron pin value, which may obscure the resonance to be measured, and the ıck of chemical stability of the standards. The use of synthetic ruby Al_2O_3 + 0.5% Cr^{+++}) is therefore suggested as a secondary standard o overcome these difficulties. Ruby has a strongly orientation ependent energy level pattern, and so interference of resonances an be minimized. In addition ruby is chemically very stable.
S.A.Ahern

538.27

12475. ELECTRON PARAMAGNETIC RESONANCE OF Co^{++} IN CORUNDUM. G.M.Zverev and A.M.Prokhorov.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 647-8 (Feb., 1959).
In Russian.

Using a single crystal of corundum with Co impurity at T = 4.2° K and frequencies 9800 and 37 500 Mc/s paramagnetic resonance of the Co ion was found, the lines having a hyperfine structure of 8 components corresponding with a Co^{59} spin value I = 7/2. The effects observed with magnetic field parallel and perpendicular to the trigonal axis of the crystal can be explained by a Co^{++} ion with effective spin $S' = \frac{1}{2}$, the g-factors measured with respect to the centre of lines are $g_{||} = 2.27$ and $g_{\perp} = 4.95$.
C.R.S.Manders

538.27 : 539.14

DYNAMIC NUCLEAR POLARIZATION. See Abstr. 11427

538.27

12476. A PARAMAGNETIC AMPLIFIER AND GENERATOR USING Fe^{3+} IONS IN CORUNDUM. L.S.Kornienko and A.M.Prokhorov.
L.S.Kornienko and A.M.Prokhorov.
Zh. eksper. teor. Fiz., Vol. 36, No. 3, 919-20 (March, 1959).
In Russian.

Fe^{3+} ions in the Al_2O_3 lattice [haematite], when the applied magnetic field is at an angle to the trigonal axis and of a magnitude of about 1200 Oe, have been used for the generation and amplification of 3.2 cm waves. The temperature was 1.8° K. Levels with an M quantum number of $-\frac{5}{2}, -\frac{3}{2}, -\frac{1}{2}$ were used. A.L.Mackay

538.27 : 539.12

USE CYCLOTRON RESONANCE CURVE FOR RELATIVISTIC ELECTRONS IN NEW TYPE MASER. See Abstr. 11353

538.27

12477. INDIRECT NUCLEAR SPIN INTERACTIONS IN WEAK FIELDS. D.Roux.
Helv. phys. Acta, Vol. 31, No. 5, 511-41 (1958). In French.

Describes apparatus for H^1 and F^{19} magnetic resonance measurement for Larmor frequencies in the range 200 c/s to 50 kc/s. It is used to study "strong" indirect spin–spin coupling (J) of 400 to 1000 c/s when the chemical shift for a given nucleus is small. This sometimes simplifies the spectra and allows a very accurate measurement of J. The degree of dissociation of H_2PO_2 and H_3PO_3 in aqueous solution was studied in this way.
J.G.Powles

538.27

12478. NUCLEAR POLARIZATION VIA "HOT" CONDUCTION ELECTRONS. G.Feher.
Phys. Rev. Letters, Vol. 3, No. 3, 135-7 (Aug. 1, 1959).

It is shown that polarization of nuclei which relax through an electron spin system should be obtained if a difference is maintained between the electron spin temperature and the temperature corresponding to the mean kinetic energy of the electrons. It was demonstrated that the acceleration of electrons in phosphorus-doped silicon by an electric field could produce such a temperature difference, but the number of electrons involved was too small to produce a sizable nuclear polarization. E.F.W.Seymour

538.27

12479. MOTIONAL EFFECTS IN NUCLEAR MAGNETIC RESONANCE. J.G.Powles.
Arch. Sci. (Geneva), Vol. 12, Special No., 87-98 (1959).

1959 Maxwell-Ampere Conference paper (see Abstr. 11542 of 1959). A review of the various motional effects which can be studied by nuclear magnetic resonance. J.G.Powles

538.27

12480. ROTATIONAL NARROWING OF NUCLEAR MAGNETIC RESONANCE SPECTRA. E.R.Andrew.
Arch. Sci. (Geneva), Vol. 12, Special No., 103-8 (1959).

1959 Maxwell-Ampere Conference paper (see Abstr. 11542 of 1959). A study of the effects produced by macroscopic rotation of the sample for spectra showing line broadening due to field inhomogeneity, nuclear spin exchange, anisotropy of chemical shift or Knight shift, or electric quadrupole interactions. J.G.Powles

538.27

12481. A SIMPLE THERMOSTATED PROBE ASSEMBLY FOR HIGH RESOLUTION NUCLEAR MAGNETIC RESONANCE SPECTRA. S.Brownstein.
Canad. J. Chem., Vol. 37, No. 6, 1119-21 (June, 1959).

The modification of a commercial, spun sample, coil assembly for use in a demountable thermostatic probe assembly is described. A.J.Manuel

538.27

12482. A METHOD OF REDUCING RADIATION DAMPING IN NUCLEAR MAGNETIC RESONANCE. R.Chidambaram.
Nuovo Cimento, Vol. 13, No. 2, 405-9 (July 16, 1959).

In high resolution nuclear magnetic resonance spectroscopy, radiation damping often distorts the line shapes. To reduce this effect, it has been found necessary to decrease parameters which are generally kept large from signal-to-noise considerations. It is suggested that by application of negative feedback to the resonant circuit containing the sample, the radiation damping effect may be reduced without deterioration in the signal-to-noise ratio.

538.27

12483. ROTARY SPIN ECHOES. I.Solomon.
Phys. Rev. Letters, Vol. 2, No. 7, 301-2 (April 1, 1959).

If an r.f. field H_1 rotating at the Larmor frequency about H_0 is reversed in phase after a time $t = \tau$ a "rotary spin echo" appears at $t = 2\tau$. Decay is unaffected by inhomogeneity of H_0 or H_1, except through self-diffusion, and the effect of this can be reduced, as in the Carr–Purcell method (see Abstr. 6788 of 1954), by reversing the phase of H_1 at times $t = \tau, 3\tau, 5\tau, \ldots$ An advantage over the C–P method is that reversal errors are not cumulative, and up to 1000 echoes can be observed. The method is thus particularly suitable for long relaxation times; it is found that in oxygen-free benzene $T_2 = 19.6 \pm 1.5$ sec. R.G.Chambers

538.27

12484. SIGNAL-TO-NOISE RATIO IN A REGENERATIVE DETECTOR OF NUCLEAR PARAMAGNETIC RESONANCE. I.F.Shchegolev.
Dokl. Akad. Nauk SSSR, Vol. 123, No. 1, 64-7 (1958). In Russian.

An expression for the signal-to-noise ratio is obtained, based on the equations of Abstr. 2529 (1948). Results are given of an experimental investigation of the ratio with a generator similar to the one used by Pound and Knight (Abstr. 5941 of 1950). J.M.Zarzycki

538.27

12485. THE FINE STRUCTURE OF THE PROTON MAGNETIC RESONANCE IN THE LIQUID CRYSTAL P-AZOXYANISOL. H.Lippmann.
Ann. Phys. (Leipzig), Folge 7, Vol. 2, No. 5-6, 287-312 (1958). In German.

A detailed study of the broad (several gauss) proton resonance signal in the liquid crystal "phase" (90.3° to 136° C) of p-azoxyanisol ($CH_3OC_6H_4NNOC_6H_4OCH_3$) in a field of 7700 G. The results are interpreted in terms of the freedom of motion of the molecules and of the CH_3 groups using the line shapes and second moments. The degree of orientation of the long molecular axis in the direction of the field is estimated and also the mean square angular deviation from this direction. The latter increases from about 24° to about 36° over the liquid crystal temperature range. The results suggest that a large proportion of the molecules are lined up but that they rotate with the usual freedom about their long axis. The analysis is rather complicated and is different from that of Jain, Lee and Spence (Abstr. 5930 of 1955). The valence angle of the oxygen in the methoxy group is estimated to be 118.5°. J.G.Powles

538.27 : 532.783

12486. NUCLEAR RESONANCE INVESTIGATIONS IN LIQUID CRYSTALS: ON THE QUESTION OF MOLECULAR ROTATION IN THE SMECTIC PHASE. K.H.Weber.
Ann. Phys. (Leipzig), Folge 7, Vol. 3, No. 3-4 125-36 (1959). In German.

An interpretation is given of proton resonance line-width measurements in two substances having liquid crystal phases, based on a consideration of the inter- and intra-molecular contributions to the second moment. It is concluded that the molecules reorient relatively easily about their long axes in both the nematic and smectic phases. J.G.Powles

538.27

12487. PROTON RESONANCE IN SINGLE CRYSTALS OF THIOUREA. J.W.Emsley and J.A.S.Smith.
Arch. Sci. (Geneva), Vol. 12, Special No., 122-6 (1959).

1959 Maxwell-Ampere Conference paper (see Abstr. 11542 of 1959). The proton resonance spectra show the thiourea molecule undergoes hindered rotation about the carbon–sulphur bond axis. J.G.Powles

538.27

12488. PROTON MAGNETIC RESONANCE RELAXATION AND SELF DIFFUSION IN THE PRIMARY ALCOHOLS AT 25° C. J.G.Powles and D.Cutler.
Arch. Sci. (Geneva), Vol. 12, Special No., 135-40 (1959).

1959 Maxwell-Ampere Conference paper (see Abstr. 11542 of 1959). Values of T_1 at 250 gauss, T_2 at 0.73 gauss and D all at 25° C are given for the series of primary alcohols from methyl to octyl. The results are interpreted in terms of motion of chain links. Relaxation in methyl alcohol is complex. T_1 and T_2 differ in methyl alcohol and water. J.G.Powles

538.27

12489. DYNAMIC POLARIZATION OF PROTONS AT LOW TEMPERATURES. M.Borghini and A.Abragam.
C.R. Acad. Sci. (Paris), Vol. 248, No. 12, 1803-5 (March 23, 1959). In French.

The method of "dynamic polarization" (Abstr. 7316 of 1958) has been applied to a solution, 10% by weight of D.P.P.H. in polystyrene at 4.2° K. By power irradiation at the appropriate frequency (just off the electron resonance) a polarization of the protons in the polystyrene of 1.5% is achieved, i.e. enhancement by a factor of 50. It is hoped to produce higher polarization and the method may become of interest as a method of nuclear alignment. J.G.Powles

538.27

12490. C^{13} SPLITTINGS IN PROTON MAGNETIC RESONANCE SPECTRA. I. HYDROCARBONS. N.Muller and D.E.Pritchard.
J. chem. Phys., Vol. 31. No. 3, 768-71 (Sept., 1959).

Indirect spin–spin couplings between protons and C^{13} nuclei were measured for a number of hydrocarbons. The results are interpreted on the basis of a simple semi-empirical equation relating the coupling constants with the amounts of s-character of the carbon-atomic orbitals involved in the bonds. No evidence is found for a dependence of the coupling constants on supposed changes in ionic character of the bonds. An equation is also presented relating the coupling constants and the C–H internuclear distances. This provides a new indirect means of evaluating C–H distances, with a reliability apparently at least comparable with that of methods in current use.

538.2

12491. APPLICABILITY OF THE MACROSCOPIC MAGNETIC SUSCEPTIBILITY MODEL TO SOLVENT EFFECTS IN PROTON NUCLEAR MAGNETIC RESONANCE.
R.E.Glick, D.G.Kates and S.J.Ehrenson.
J. chem. Phys., Vol. 31, No. 2, 567-8 (Aug., 1959).

Contrary to the recent theoretical work of Bothner-By and Glick (Abstr. 8066 of 1957), it has been found experimentally that proton N.M.R. solvent effects can be satisfactorily described by the equation $\Delta H = \alpha (\kappa - \kappa_0)$ (where ΔH is the shift of the N.M.R. line for a particular solute proton from the position in a solvent of magnetic susceptibility κ, to that in a reference solvent of susceptibility κ_0, and α is a shape factor) for the following solute materials: methylene chloride, dioxane, di-t-butylperoxide, n-cetane, tetra-(trimethylsiloxy)-silane, dissolved in the ten chloro- and/or bromo methanes from methylene chloride to dichlorodibromomethane. The implications of these results are discussed. S.A.Aher

538.2

12492. NUCLEAR MAGNETIC DOUBLE RESONANCE EXPERIMENT ON TWO PROTON SYSTEM. J.Itoh and R.Kusaka.
J. Phys. Soc. Japan, Vol. 14, No. 4, 492-8 (April, 1959).

The two-proton system in K HgCl .H O single crystals was studied. Applying a strong r.f. field with the frequency nearly equa to that of one line in the doublet of two-proton resonance, the line shape of the other line of the doublet was measured for various values of the intensity and frequency of the strong r.f. field. Generally, the observed line shape shows further doublet structure, and t separation and relative intensities of this doublet depend upon the

nsity and frequency of the strong r.f. field. Some calculations e made for the line structure of a two-proton system under the ience of a strong r.f. field. The experimental results agree itatively with the calculation, but some discrepancies exist in absolute magnitudes of the splitting of the induced doublet.

538.27 : 539.217

NUCLEAR MAGNETIC RESONANCE DETERMINATION OF TIVATION VOLUME FOR DIFFUSION IN LITHIUM. See tr. 11588

538.27

93. MOLECULAR MOTION IN SOME SOLID HYDROCARBONS. Lawrenson and F.A.Rushworth.
h. Sci. (Geneva), Vol. 12, Special No., 116-21 (1959).
1959 Maxwell-Ampere Conference paper (see Abstr. 11542 of 9). Nuclear resonance absorption in n-pentane, n-hexane, ctane and cyclo-pentene down to 20°K. In the paraffins methyl up reorientation still occurs even at 20°K. Cyclo-pentene is wn to be non-planar. There is evidence of self diffusion just w the melting point. J.G.Powles

538.27

94. NUCLEAR MAGNETIC RESONANCE IN SOME SOLID DROCARBONS. R.G.Eades, N.D.Finch and Z.M.El Saffar.
ch. Sci. (Geneva), Vol. 12, Special No., 109-15 (1959).
1959 Maxwell-Ampere Conference paper (see Abstr. 11542 of 9). Proton spectra of cyclohexene, 123- and 135-trimethyl zene between 80° and 220°K. Methyl group rotation is effective he methyl benzenes at 80°K. T_1 for 123- is lower than for 135- icating cooperative hindering of methyl groups in 123-trimethyl nzene. J.G.Powles

538.27

95. N.M.R. OF WATER SORBED ON Al_2O_3. H.Winkler.
ch. Sci. (Geneva), Vol. 12, Special No., 161-3 (1959).
1959 Maxwell-Ampere,Conference paper (see Abstr.11542 of 9). T_1 and T_2 at room temperature for various water concentra- ns from a monomolecular layer to a maximum by spin–echo tech- ues. The results are interpreted in terms of micro and macro es. T_1 and T_2 differ by factors of 3-10 and are of order 10^{-3} sec, explanation is given. J.G.Powles

538.27

96. NUCLEAR RELAXATION IN LIQUIDS AT VERY LOW EQUENCIES. G.Hochstrasser.
ch. Sci. (Geneva), Vol. 12, Special No., 132-4 (1959). In French.
1959 Maxwell-Ampere Conference paper (see Abstr.11542 of 9). A spectrometer operating at 2 kc/s with a resolution proaching 1 in 10^6. Direct measurements of the line width of ter and benzene at 20°C have been made. J.G.Powles

538.27

97. N.M.R. IN AMPHIPHILIC SOLUTIONS. M.P.McDonald.
ch. Sci. (Geneva), Vol. 12, Special No., 141-51 (1959).
1959 Maxwell-Ampere Conference paper (see Abstr. 11542 of 9). A study of the high resolution proton spectra of one or two es of amphiphilic organic substances in water in the normal and uid crystal state. Evidence of an unexpected degree of order in hydrocarbon chains in the liquid crystal state is found. J.G.Powles

538.27 : 539.21

98. RADIATION DAMAGE BY HIGH POLYMERS STUDIED BY M.R. A.Lösche.
ch. Sci. (Geneva), Vol. 12, Special No., 205-6 (1959).
1959 Maxwell-Ampere Conference paper (see Abstr. 11542 of 9). Line broadening in Nylon 6 as a result of weak γ-irradiation er periods of up to six months. Possible use as a radiation dose ter. J.G.Powles

538.27 : 539.2

99. NUCLEAR MAGNETIC RESONANCE STUDIES OF DIS- CATIONS IN NaI AND KI. J.F.Hon and P.J.Bray.
appl. Phys., Vol. 30, No. 9, 1425-8 (Sept., 1959).
Intensity anomalies have been found in the nuclear magnetic sonance of I^{127} in NaI and KI single crystals when the magnetic ld is along a [1,0,0] type direction. The intensity enhancement in ese cases indicates a collapse of the satellite transitions ($m \rightarrow m-1$, $\neq \frac{1}{2}$) into the central transition ($m = \frac{1}{2} \rightarrow m = -\frac{1}{2}$). It is concluded at the crystals contain edge and/or screw dislocations which are preferentially oriented along [1,1,0] and [1,0,0] type directions, respectively. The degree of orientation is greater in NaI than in KI. These studies afford an explanation of anomalous resonance line widths reported for NaI by other observers.

538.27

12500. NUCLEAR MAGNETIC RESONANCE IN SUPERCONDUCTING TIN. G.M.Androes and W.D.Knight.
Phys. Rev. Letters, Vol. 2, No. 9, 386-7 (May 1, 1959).
In order to avoid previously encountered difficulties associated with a distribution of particle sizes, samples of β-tin consisting of arrays of platelets all of the same dimensions were made by an evaporation technique. The conduction electron shift decreased as the reduced temperature decreased, extrapolating to 0.55%, rather than zero, (referred to the resonance in $SnCl_4$) at the absolute zero. The line width varied linearly with magnetic field and inversely as the particle size. E.F.W.Seymour

538.27

12501. OBSERVATION OF NUCLEAR RESONANCE IN A FERROMAGNET. A.C.Gossard and A.M.Portis.
Phys. Rev. Letters, Vol. 3, No. 4, 164-6 (Aug. 15, 1959).
A strong Co^{59} resonance was observed at room temperature in finely divided face-centred-cubic cobalt metal, at a frequency of 213.1 Mc/s in zero applied field. This frequency agrees well with that deduced from low temperature specific heat measurements on hexagonal cobalt. The large signal intensity is attributed to enhancement of the radio-frequency field by an induced rotating component of the hyperfine field. E.F.W.Seymour

538.27

12502. APPROACH TO BOLTZMANN EQUILIBRIUM OF THE NUCLEAR SPINS IN A QUADRUPOLAR SOLID. W.I.Goldburg.
Phys. Rev., Vol. 115, No. 1, 48-56 (July 1, 1959).
A single crystal of $NaNO_3$ was oriented in an external magnetic field at an angle (θ_1) for which the quadrupole splitting is large. With radiofrequency radiation, a pair of Zeeman levels of the sodium nuclear spin system ($I = \frac{3}{2}$) was saturated. Then the crystal was quickly rotated to an angle where the inequality of the level spacings is a minimum (approximately $\frac{1}{2}$ the line width) and where spin mixing can take place. The crystal was then quickly returned to θ_1 where, by nuclear resonance pulse-techniques, the populations of the four sodium levels could be determined. This sequence of operations was completed in a time short compared to the spin–lattice relaxation time. When the $m = \pm\frac{1}{2}$ levels were initially saturated, the spin system rapidly came to the expected spin temperature $T_S = (10/9) \times$ (the lattice temperature). When the outer satellites were saturated, however, the resulting equilibrium populations of the levels were not those of a Boltzmann distribution. Also measured was the rate of approach of the spin system to equilibrium for various larger splittings. For splittings of the order of the line width, an unexpected plateau appeared in the spin mixing rate. The usual rate equations do not seem adequate to describe the observed dynamic behaviour of this spin system.

538.27

12503. INFLUENCE OF MOLECULAR MOTION ON PURE QUADRUPOLE NUCLEAR MAGNETIC RESONANCE IN SOLIDS. M.Buyle-Bodin.
Arch. Sci. (Geneva), Vol. 12, Special No., 166-76 (1959). In French.
1959 Maxwell-Ampere Conference paper (see Abstr. 11542 of 1959). A review of the effect of molecular motion of various types on pure quadrupole resonance spectra, including motion of the chemical bond, torsional motions, hindered rotational motion, and the effect of phase changes. J.G.Powles

538.27

12504. EFFECTS OF CRYSTALLINE DEFECTS ON PURE QUADRUPOLE RESONANCES. J.L.Randall, W.G.Moulton and W.B.Ard, Jr.
J. chem. Phys., Vol. 31, No. 3, 730-5 (Sept., 1959).
The linewidth and second moment of the Cl^{35} pure quadrupole line were measured as functions of X-irradiation time and inhomogeneous compression in sodium chlorate, potassium chlorate, and p-dichlorobenzene. The effect of the addition of p-dibromobenzene to p-dichlorobenzene was also studied. In all cases an increase in the linewidth and second moment was observed, and in a few cases, a decrease in the integrated intensity was found. Several broadening mechanisms are considered in detail, and it is concluded that strain broadening is probably the predominant mechanism in all cases.

538.27 : 536.424

PHASE CHANGES IN KIO_3 DETECTED BY NUCLEAR QUADRUPOLE RESONANCE. See Abstr. 12180

ELECTROMAGNETISM

MAGNETOHYDRODYNAMICS

538.3 : 530.12

12505. THE MATERIAL EQUATIONS IN ARBITRARY MEDIA.
M.Tischer and S.Hess.
Ann. Phys. (Leipzig), Folge 7, Vol. 3, No. 3-4, 113-21 (1959). In German.

Following the generalization of the two equations introducing the dielectric constant and the permeability by Marx (Abstr. 6737 of 1954) and by Schmutzer (Abstr. 3459 of 1957) a covariant formulation including also Ohm's law is given. This leads to a new equation for the magnetic part of the current arising from the motion of the medium. Apart from the factor $(1 - v^2/c^2)^{1/2}$, the current tensor is the same as that defined by Schlomka (Abstr. 6357 of 1951). W.A.Hepner

538.3

12506. THE PHYSICAL SIGNIFICANCE OF THE VECTORS $\vec{B}$ AND $\vec{H}$ OF CLASSICAL ELECTROMAGNETISM.
J.G.Roederer.
Cienc. e Invest., Vol. 15, No. 1-2, 19-29 (Feb., 1959). In Spanish.

Various considerations, including the nature of the macroscopic field in a ferromagnetic medium, are introduced to suggest that the physically significant vector is the solenoidal field $\vec{B}$.

R.A.Newing

538.3

12507. ON THE INTERACTION BETWEEN A MEDIUM AND A RING CURRENT INCIDENT ON IT. V.N.Tsytovich.
Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1407-16 (1958). In Russian.

The spectral distributions of the current in a ring which impinges with a constant relativistic velocity on a medium possessing arbitrary $\epsilon(\omega)$ and μ, are analysed. The reflection criterion for non-relativistic velocities and expressions for the acting forces are deduced.

538.3

12508. ON THE MOTION OF A CHARGED PARTICLE IN AN ANISOTROPIC MEDIUM. G.A.Begiashvili and É.V.Gedalin.
Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1513-17 (1958). In Russian.

Expressions for the electromagnetic field components are derived and the total energy losses are determined for a charged particle moving in an anisotropic gyroelectric and gyromagnetic medium.

538.3 : 530.12

GEOMETRY OF GRAVITATION AND ELECTROMAGNETISM. See Abstr. 11784

538.3 : 532.5

12509. SURFACE VIBRATIONS OF A [HYDRODYNAMIC] CHARGED COLUMN IN A LONGITUDINAL [EXTERNAL] MAGNETIC FIELD. Chzhao Kéi-khua.
Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1475-80 (1958). In Russian.

The investigation is an extension of the work of Kruskal and Schwarzschild (Abstr. 6324 of 1954) and Tayler (Abstr. 4411 of 1957 and 631 of 1958) on the stability of an uncharge hydrodynamic column. A dispersion equation for surface waves is found and various consequences relating to the vibration spectrum are analysed. From the experimental standpoint, these results may be useful for elucidation of the nature of radiation from a plasma in a magnetic field.

538.3 : 532.5 : 534.222.2

SHOCK WAVES IN A CONDUCTING ULTRARELATIVISTIC GAS. See Abstr. 11937

ELECTROMAGNETIC WAVES AND OSCILLATIONS

538.561

12510. USE OF THE PRINCIPLES OF CONSERVATION OF ENERGY AND MOMENTUM IN CONNECTION WITH THE OPERATION OF WAVE-TYPE PARAMETRIC AMPLIFIERS. J.R.Pierce.
J. appl. Phys., Vol. 30, No. 9, 1341-6 (Sept., 1959).

The operation of a wave-type parametric amplifier may be thought of in terms of the force exerted by travelling discontinuities or reflecting elements on the waves present in the device. By invoking the principles of conservation of energy and momentum it is possible to understand in very simple terms certain limitations on the operation of such devices and to arrive very easily at certain general relations governing their behaviour, including the Manley–Rowe relation. It is proposed that for a guided wave the momentum per unit distance is the power divided by the product of the group and phase velocities.

538.561 : 537.311.33 : 621.373.5 : 621.382.22

IMPROVED DIODE FOR THE HARMONIC GENERATION OF MILLIMETER- AND SUBMILLIMETER WAVES. See Abstr. 12286

538.566 : 621.396.81

12511. TRANSMISSION AND REFLECTION BY A PARALLEL WIRE GRID. M.T.Decker.
J. Res. Nat. Bur. Stand., Vol. 63D, No. 1, 87-90 (July-Aug., 1959).

A comparison is made at X-band frequencies of the theoretical and measured transmission and reflection coefficients for a parallel wire grid. The methods used are applicable to the measurements of these factors for various building materials.

538.566 : 534.26

MULTIPLE SCATTERING BY A RANDOM STACK OF DIELECTRIC SLABS. See Abstr. 11959

538.566

12512. DIFFRACTION OF ELECTROMAGNETIC WAVES USING BRAUNBEK'S APPROXIMATION. II. W.E.Frahn.
Z. Phys., Vol. 156, No. 2, 99-116 (1959). In German.

For Pt I, see Abstr. 11290 (1959). The method developed in Pt I is applied to the near field of the circular aperture and the circular disk. The field distributions along the central axis and in the plane of the screen are calculated and compared with the results of both the rigorous solution and of Kirchhoff's approximation. The relation of Braunbek's method to other approximation methods for the optical region is discussed.

538.566 : 621.372.8

12513. USING ASYMPTOTIC INTEGRATION OF THE WAVE EQUATION TO SOLVE SOME WAVEGUIDE AND RESONATOR PROBLEMS. A.Gutman.
Dokl. Akad. Nauk SSSR, Vol. 125, No. 6, 1252-6 (April 21, 1959). In Russian.

In guided-wave structures of variable cross-section where a cut-off dimension occurs and the so-called Schwarz differential is small it is possible to use the W.K.B. method of approximate solution to equations with variable parameters. Two examples are considered. The first concerns the successive widening and narrowing within a finite interval of an otherwise infinite waveguide; the second structure is semi-infinite and is in effect a resonator of tapering section between a shorting plate and a cut-off section. Some experimental results are quoted on a tapering length of septate guide which show satisfactory agreement with calculation. S.C.Dutta

538.566 : 621.396.67

12514. EFFECTIVE ANTENNA TEMPERATURES DUE TO OXYGEN AND WATER VAPOR IN THE ATMOSPHERE. D.C.Hogg.
J. appl. Phys., Vol. 30, No. 9, 1417-19 (Sept., 1959).

Calculations of the effective noise temperature at the terminals of a high gain aerial due to oxygen and water vapour in the atmosphere are given for the frequency range 0.5 to 40 kMc/s. In the 1 to 10 kMc s band, the effective temperature increases from about 3° to 100° K as the zenith angle is increased from 0° to 90°. Calculated values of the total attenuation through the atmosphere are given

538.566.2

515. LONGITUDINAL AND TRANSVERSE WAVES IN THE RENTZ PLASMA. K.Rawer and K.Suchy.
n. Phys. (Leipzig), Folge 7, Vol. 3, No. 3-4, 155-70 (1959). German.

A discussion of solutions of the third-degree equation for dis- rsion of electromagnetic waves in an inhomogeneous plasma of nperature T and in a uniform magnetic field, it being assumed it the heavy positively-charged particles are immobile. The alysis starts from the Boltzmann equation for the electrons, uses -sheeted Riemann surface, and includes the Appleton–Hartree sults as a special case (T = 0). B.Meltzer

538.566.2 : 621.396.8

516. CLIMATOLOGY OF GROUND-BASED RADIO DUCTS. R.Bean.
Res. Nat. Bur. Stand., Vol. 63D, No. 1, 29-34 (July-Aug., 1959).

An atmospheric duct is defined as occurring when geometrical tics indicate that a radio ray leaving the transmitter and passing wards through the atmosphere is sufficiently refracted that it is ıvelling parallel to the earth's surface. Maximum observed inci- nce of ducts was determined as 13% in the tropics, 10% in e arctic and 5% in the temperate zone by analysis of 3 to 5 ars of radiosonde data for a tropical, temperate, and arctic cation. Annual maxima are observed in the winter for the arctic d summer for the tropics. The arctic ducts arise from ground- sed temperature inversions with the ground temperature less than 15° C while the tropical ducts are observed to occur with slight mperature and humidity lapse when the surface tmperature is ° C and greater.

538.566.2

517. MODE EXPANSION IN THE LOW-FREQUENCY RANGE)R PROPAGATION THROUGH A CURVED STRATIFIED ATMOS- IERE. H.Bremmer.
Res. Nat. Bur. Stand., Vol. 63D, No. 1, 75-85 (July-Aug., 1959).

This expansion is particularly useful when considering iono- heric propagation at low frequencies. The complex problem deal- g with two media — a homogeneous earth and a surrounding ratified atmosphere — leads to intractable expressions. However, the influence of the earth may be accounted for by an approximate undary condition at the earth's surface, the problem is then re- ced to that of the outer medium only. The coefficients of the mode pansion for this simplified problem will be derived while taking o account the earth's curvature; however, the latter proves to be gligible under very general conditions. The expansion to be de- ved is wanted in particular when studying the influence of a gradual ansition in the electron density with height at the lower edge of the iosphere.

NUCLEAR AND ATOMIC PHYSICS

APPARATUS . PARTICLE DETECTORS

539.1.07 : 539.17

2518. HALOGEN BETA-COUNTER MONITORS FOR CHALK IVER REACTORS. I.L.Fowler, A.Pearson and L.A.K.Watt.
ucleonics, Vol. 17, No. 1, 78, 80, 82-3 (Jan., 1959).

Special counters with conical cathodes and end windows $\frac{3}{4}$ in. diameter were designed as fission product monitors for the etection of fuel element bursts in the reactors. The monitor circuit ses a cold-cathode tube in a counting rate circuit. At high counting ates this circuit saturates and the counter current is read directly. he instrument has a logarithmic calibration covering three decades. xtension to cover six decades is possible. Characteristics of ounters have been followed over periods of several years and up to 10^{12} counts and excellent stability observed. R.D.Smith

539.1.07 : 539.16.08

ESTIMATION OF C^{14} IN THE GAS PHASE IN A GEIGER- ÜLLER COUNTER FILLED WITH A MIXTURE OF CO_2 OR CO ND A HEAVY SATURATED HYDROCARBON. See Abstr. 11434

539.1.07

12519. CONTINUOUS AIR MONITOR FOR H^3.
J.Brinkerhoff, C.A.Ziegler, R.Bersin and D.J.Chleck.
Nucleonics, Vol. 17, No. 2, 76, 78, 81 (Feb., 1959).

Air is drawn in through a particulate filter and a parallel plate ion sweeper into a 46 l."holding" volume. The ions formed in this volume are swept into an ionization chamber. On the most sensitive range the instrument reads full scale for 0.23 mr/hr (1 mpc). It is linear up to 100 mpc. R.D.Smith

539.1.07

12520. SIMPLIFIED AIR-SAMPLING METHOD. R.D.Thomas.
Nucleonics, Vol. 17, No. 5, 134, 136 (May, 1959).

Particulate contaminants are precipitated electrostatically on the inner wall of a sampling tube. The tube is then used as the wall of an ionization chamber and the ionization current measured. R.D.Smith

539.1.07

12521. THE ENERGY DEPENDENCE OF THE CORNELL THICK-WALLED IONIZATION CHAMBER.
F.J.Loeffler, T.R.Palfrey and G.W.Tautfest.
Nuclear Instrum. and Methods, Vol. 5, No. 1, 50-5 (July, 1959).

The absolute response of a thick-walled ionization chamber has been determined in the energy region 60-322 MeV. The determination is the result of (1) intercomparisons with chambers calibrated absolutely, (2) absolute calibration at two energies, and (3) measurements of the relative energy dependence by pair-spectrometer and $Cu^{63}(\gamma,n)Cu^{62}$ activation methods. A plot of the results obtained is given and a comparison with the prediction of shower theory made.

539.1.07

12522. RECENT DEVELOPMENTS IN SCINTILLATION COUNTING. J.B.Birks.
Sci. Progr., Vol. 47, 484-94 (July, 1959).

A short review of the principles, practice and recent applications of scintillation counting. J.B.Birks

539.1.07 : 535.37

PLASTIC SCINTILLATORS. DISCRIMINATION OF FAST NEUTRONS IN γ-RAY BACKGROUND. See Abstr. 12121

539.1.07

12523. MAKING FISSION COUNTERS FOR NEUTRON MONITOR- ING. J.M.McKenzie.
Nucleonics, Vol. 17, No. 1, 60-5 (Jan., 1959).

The counters are designed for a wide counting range (up to 6 decades) and to have good discrimination against pulses due to α-particle pile-up. The counters are filled with argon or A–CH_4 mixtures. Only the cathodes are coated and thicknesses of less than 1 mg/cm^2 are used to avoid loss of counts by absorption. Full constructional and performance details are given for a cylindrical counter used for flux measurement in the Chalk River reactors and for a thin walled parallel plate counter used for measuring neutron beams. R.D.Smith

539.1.07 : 537.311.33

12524. COATED SEMICONDUCTOR IS TINY NEUTRON DETECTOR.
R.V.Babcock, R.E.Davis, S.L.Ruby, K.H.Sun and E.D.Wolley.
Nucleonics, Vol. 17, No. 4, 116, 118, 120, 122 (April, 1959).

Charged particles passing through a semiconductor form e-h pairs that diffuse into a p-n junction and produce voltage pulses. Thermal neutrons may be detected by coating the crystals with a thin layer of B^{10} or Li^7 to produce α-particles, or with a thermally fissile material to produce fission-fragments. Fast neutrons can be detected using a thin layer of paraffin to produce knock-on protons or by using a fissionable material. The detectors are very small (~1 mm) allowing high spatial resolution to be obtained. Sensitivities are low-between 10^{-4} and 10^{-7} count n^{-1} cm^{-1} Short rise pulse rise times and good discrimination against γ-pulses are obtained. R.D.Smith

539.1.07

12525. EXPERIMENTS ON THE "STICKY PAPER" METHOD OF RADIOACTIVE FALLOUT SAMPLING.
D.W.Keam, L.J.Dwyer, J.H.Martin, D.J.Stevens and E.W.Titterton.
Austral. J. Sci., Vol. 21, No. 4, 99-104 (Nov., 1958).

An account is given of experiments carried out in Australia following weapon tests at Maralinga in 1957. The consistency of measurement of the sticky paper technique was examined as a function of distance from the weapons test site and intercomparisons

were made with the open pot method. It is concluded that the sticky paper method is most suitable for the study of global fallout, when this is old or in aerosol form, that the minimum detectable activity is 0.002 $\mu c/m^2$, and that this method and the highwalled pot method have nearly equal efficiencies. A.E.I. Research Laboratory

539.1.07

12526. CORRECTION FACTORS FOR THE ABSOLUTE DOSIMETRY OF PLANE SOURCES OF β-EMISSION, BY A GEIGER–MÜLLER COUNTER. J.Matoušková.
Czech. J. Phys., Vol. 8, No. 2, 154-70 (1958). In Russian.

Derives a general equation for the self-absorption factor of a homogeneous plane source. It can be used in cases when the area of the source is comparable to that of the limiting aperture of the diaphragm. Also discusses the effect of the thickness of the diaphragm on the geometrical efficiency of the source. See also Abstr. 10435 (1954). J.M.Zarzycki

539.1.07

12527. ON BUBBLE CHAMBERS. H.Slätis.
Nuclear Instrum. and Methods, Vol. 5, No. 1, 1-25 (July, 1959).

Survey. Glaser's theory is briefly reproduced. Different types of bubble chamber are described, and photographs of tracks demonstrate their application. 56 references.

539.1.07

12528. TRANSISTORS SHRINK CONTAMINATION DETECTORS. W.G.Spear.
Nucleonics, Vol. 17, No. 4, 97-101 (April, 1959).

Circuit details of an α hand-monitor and a single channel portable kicksorter. The α-monitor uses zinc sulphide screens viewed by four photomultipliers. Transistors are used in power supplies, amplifiers and driving circuits for the registers. The kicksorter uses a 2 in. × 2 in. NaI crystal and has a resolution of about 20 keV over the operating range of 0.1 to 1.5 MeV. The operating power is 0.36 W. R.D.Smith

539.1.07 : 778.34

PARTICLE PHOTOGRAPHY. 1957 STRASBOURG CONFERENCE. See Abstr. 11700

539.1.07 : 539.165 : 621.374.32

12529. A NEW MULTICHANNEL PULSE HEIGHT ANALYSER AND ITS APPLICATION IN THE DETERMINATION OF THE DIFFERENTIAL β–γ ANGULAR CORRELATION OF Rb^{86}. H.Klewer.
Z. angew. Phys., Vol. 11, No. 3, 81-8 (March, 1959). In German.

In this apparatus the function of measurement of pulse height is separated from that of display. The amplitude of the incoming pulses is converted into a time interval which is then recorded on magnetic tape as a corresponding number of oscillations of a constant frequency. The tape can then be played back on a mechanical translation system which converts these signals into a pulse height distribution. The differential β–γ angular correlation of Rb^{86} is shown, obtained on this apparatus using 127 channels.
A.E.I. Research Laboratory

539.1.07

12530. ANALYSIS OF SINGLE CRYSTAL PULSE-HEIGHT DISTRIBUTIONS. H.M.Childers.
Rev. sci. Instrum., Vol. 30, No. 9, 810-14 (Sept., 1959).

A method for analysing the pulse-height distribution of a single NaI crystal gamma-ray spectrometer is presented. The method consists in solving the matrix equation, $P = KN(h\nu)$, for $N(h\nu)$, the incident gamma-ray spectrum in which P is the pulse-height distribution, and K is the sensitivity matrix of the detector. A procedure for obtaining the elements of K from curves obtainable from the pulse-height distributions produced by a few standard monoenergetic sources has been devised. Experimental results are presented which demonstrate the validity of the method.

ELEMENTARY PARTICLES

539.12 : 530.1

THEORY OF ELEMENTARY PARTICLES. See Abstr. 11822

539.12 : 530.1

PARITY EXPERIMENTS IN BETA DECAYS. See Abstr. 118

539.1

12531. ON THE GENERAL THEORY OF COLLISIONS FOR PARTICLES WITH SPIN. M.Jacob and G.C.Wick.
Ann. Phys. (New York), Vol. 7, No. 4, 404-28 (Aug., 1959).

The general analysis of binary reactions involving particles with arbitrary spin is reformulated in such a way, that it applies equally well to relativistic particles (including photons). This is achieved by using longitudinal spin components ("helicity states") not only in the initial and final states, but also in the angular momentum states which are employed as usual to reduce the S-matrix to a simpler form. Expressions for the scattering and reaction-amplitude, intensity and polarization are given. They involve few vector-addition coefficients than the customary formulas, and no recoupling coefficients. The application to some examples is sketched, and some formulae are given that may be of use in the applications.

539.

12532. PROBLEMS IN THE THEORY OF WEAK INTERACTIONS R.Gatto.
Fortschr. Phys., Vol. 7, No. 3, 147-81 (1959).

This article reviews the present understanding of weak interactions and shows where further experimental information is required. The V–A theory is used throughout, and it is assumed that the weak interaction Lagrangian takes the form of the couplin of a current with itself. The forms of current possible are simpli by the selection rule $\Delta S = \pm 1$, which is imposed on possible reacti There is also evidence that the currents have $\Delta Q = \pm 1$, although it not possible to exclude completely current terms for which $\Delta Q =$ The question of whether the $\Delta Q = \pm 1$ current interactions are cau by the exchange of a heavy charged meson is discussed. The expe mental upper limit on the $\mu \rightarrow e + \gamma$ process is, however, already rather too large to be in accord with this idea. There is a sectio the possible symmetries of the current in isobaric spin space. It appears necessary to include $\Delta I = \frac{1}{2}$ and $\Delta I = \frac{3}{2}$ contributions in th decay of strange particles. Finally, the renormalization of the coupling constants due to strong interactions is considered. It appears that, if there is a universal Fermi interaction, the hypoth of the non-renormalization of the vector, strangeness-conserving current is not compatible with the present value of the Michel par meter. Some possible experimental tests of the universality of th interaction, and of this non-renormalization hypothesis, are sugg ed. It is difficult to make reliable estimates of the effect of stron interactions on the axial coupling constant in β-decay since the di persion relations required are of dubious validity. Dispersion re tions offer a promising approach to the comparison of μ-absorpti with β-decay, but there is at present little experimental informat on the former. E.J.Squi

539.12 : 537.591

ELASTICITY IN HIGH ENERGY JET EVENTS. See Abstr. 12433

539.

12533. RADIATION FROM A CHARGED PARTICLE TRAVERSI A LAMELLAR MEDIUM. G.M.Garibyan.
Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1435-9 (1958). In Russian.

The transition radiation which appears when a charged partic passes through a large number of plates separated by vacuum is considered.

539.12 : 539

12534. DIFFRACTION PHENOMENA IN COLLISIONS OF FAST PARTICLES WITH NUCLEI. A.I.Achiezer and I.J.Pomerančhuk
Fortschr. Phys., Vol. 7, No. 2, 102-44 (1959). In German.

German translation of the article in Uspekhi fiz. Nauk, Vol. 593-630 (1958). General formulae for diffraction scattering are developed, including the case where a Coulomb field is present. Among the topics treated are the Dirac equation, emission of pho

pions, photoproduction of pion pairs, nucleon pair production by a
oton and diffraction scattering and emission of fast deuterons.
G.E.Brown

539.12

535. A MODEL OF THE MULTIPLE PRODUCTION PROCESS.
.Kopylov.
. eksper. teor. Fiz., Vol. 35, No. 6(12), 1426-34 (1958). In Russian.
The suggestion of constructing a "random stars table" capable
reproducing the theoretical concepts about the multiple produc-
n of elementary particles in a form suitable for comparing with
periments is discussed. It is shown that a table of this type can
set up for energies up to 10 BeV.

539.12 : 531.717.1

TRANSMISSION OF γ-RAYS FROM THULIUM-170 THROUGH AND Fe. See Abstr. 11873

539.12 : 537.311.33

ABSORPTION OF γ-RAYS IN SEMICONDUCTORS.
e Abstr. 12246

539.12

536. POLARIZATION MEASUREMENTS ON NUCLEAR GAMMA
YS. L.W.Fagg and S.S.Hanna.
v. mod. Phys., Vol. 31, No. 3, 711-58 (July, 1959).
The various processes which may be used to measure the
arization of nuclear γ-rays are discussed and experiments using
se various methods are reviewed. A summary of experiments,
h a brief indication of the results obtained, is tabulated. There
e many references to an extensive bibliography. C.J.Batty

539.12 : 537.56

BREMSSTRAHLUNG FROM DENSE PLASMAS.
e Abstr. 12410

539.12

537. ON THE ORIGIN OF THE ELECTRON MASS.
Katayama, M.Taketani and J.Leal Ferreira.
ogr. theor. Phys., Vol. 21, No. 6, 818-26 (June, 1959).
Some possibilities for understanding the dynamical origin of the
ctron mass are examined. As the present formulation of quantum
ctrodynamics does not give, within its region of validity, a satis-
tory answer to this problem, two possibilities for obtaining the
ctron mass, starting from a zero bare mass, are presented. The
st one is a nonlocal modification of quantum electrodynamics,
ich may be closely related to the electron structure. The other
to get the electron mass from the masses of other elementary
rticles through weak interactions, because at the high energy
gion discussed here, the weak interactions become more predomin-
t compared to the electromagnetic interaction. These possibilities
n be examined by improvements in experiments. The former
pends on the experimental accuracies of the electron moment and
latter is related to the degree of coexistence of S, P, T couplings
coexistence with the main V and A couplings in β-decays and/or
the degree of the deviation from the V-A combination in the muon–
ctron interaction.

539.12 : 537.533

ANOMALIES IN THE DETERMINATION OF THE SPECIFIC
LECTRONIC CHARGE. See Abstr. 12365

539.12

538. ELECTRON–NEUTRON INTERACTION.
Ando and H.Miyazawa.
ogr. theor. Phys., Vol. 17, No. 4, 607-9 (April, 1957).
The S-wave pion contribution to the electrostatic interaction is
lculated for a fixed nucleon, using π–N dispersion relations.
R.J.N.Phillips

539.12

539. MULTIPLE SCATTERING OF POLARIZED ELECTRONS.
N.Toptygin.
h. eksper. teor. Fiz., Vol. 36, No. 2, 488-98 (1959). In Russian.
Multiple elastic scattering of polarized spin 1/2 particles in a
omogeneous and isotropic medium is considered. Approximate
olution of the kinetic equations defining the distribution function
nd polarization vector of the scattered particles is given. A solu-
on which is valid for small as well as large scattering angles has
een obtained as a series expansion in spherical functions and
pherical vectors.

539.12

12540. THE EXPONENTIAL ABSORPTION OF β-RAYS.
C.Mahaux.
Bull. Soc. Roy. Sci. Liege, Vol. 28, No. 3-4, 69-77 (March-April, 1959). In French.
Investigation measurements were made on the absorption of β-rays. By using composite absorbers the author was able to show that an exponential attenuation is obtained when little or no change in β-ray spectrum occurs in the absorber. Ultimate deviations from an exponential decay are attributed to a build-up of low energy electrons in the absorber which is in agreement with the suggestion made by Fournier and Guillot. For further work see following abstract.
A.E.I.Research Laboratory

539.12

12541. THE EXPONENTIAL ABSORPTION OF β-RAYS.
C.Mahaux.
Bull. Soc. Roy. Sci. Liege, Vol. 28, No. 5-6, 130-7 (May-June, 1959). In French.
The spectra of β-rays from In^{114} and P^{32} after passing through various thicknesses of aluminium or gold were measured. It is shown that if the position of the peak in the spectra is unchanged by the introduction of absorbers, then the absorption will follow an exponential law. C.J.Batty

539.12

12542. CONTRIBUTION TO THE STUDY OF ENERGY LOSSES SUFFERED BY ELECTRONS TRAVERSING THIN METALLIC FILMS; COMPARISON WITH THE RESULTS OF X-RAY SPECTROSCOPY. B.Gauthe.
Ann. Phys. (Paris), Ser. 13, Vol. 3, No. 11-12, 915-64 (Nov.-Dec., 1958). In French.
Reviews previous work on energy losses in thin films. New experimental data are given obtained with an electron velocity analyser of the type first used by Müllenstedt. The results agree in part with those of other authors but there are some serious differences. The question of relating electron energy losses to X-ray absorption spectra is briefly discussed.
A.E.I. Research Laboratories

539.12 : 537.311.33

12543. ON THE ABSORPTION COEFFICIENT (REDUCTION OF INTENSITY) OF BETA-RAYS IN SEMICONDUCTORS.
B.I.Boltaks and V.I.Sokolov.
Dokl. Akad. Nauk SSSR, Vol. 123, No. 3, 446-8 (Nov. 21, 1958). In Russian.
The dependence was studied of the absorption coefficient of beta-rays from various radio-isotopes on the characteristics of some semiconductors, with particular regard to the structure of the energy spectrum of the electrons and of the forbidden regions. The results are treated qualitatively and are in good agreement with theory. G.Martelli

539.12

12544. SHOWERS PRODUCED BY 100 TO 400 MeV POSITRONS.
Yu.D.Prokoshkin and Tan Syao-Vei.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 10-16 (1959).
Cascade curves for 101, 294 and 407 MeV positrons in lead and copper were measured. The curves obtained are in agreement with shower curves computed by the Monte Carlo method. Functions approximating the cascade curves have been found.

539.12

12545. THE FORMATION OF TRACKS AND THE MEASUREMENT OF THE ENERGY OF ELECTRON PAIRS.
R.Weill, M.Gailloud, P.Rosselet and C.Haenny.
"Particle photography" conference, Strasbourg, 1959 (see Abstr. 11704 of 1959) pp. 295. In French.
Introduces without details a simplified three-dimensional model of track formation by high energy electron pairs, to overcome the existing discrepancies between the experimental values for the mean gap length and gap density as a function of range, and the values calculated on the basis of the dipole model. S.J.St-Lorant

539.12 : 539.18

COULOMB DEFLECTION EFFECTS ON PAIR-PRODUCTION.
See Abstr. 11522

539.12

12546. THREE-PION CONTRIBUTION TO THE ELECTRO-MAGNETIC STRUCTURE OF THE NUCLEON.
B.Bosco and V.De Alfaro.
Phys. Rev., Vol. 115, No. 1, 215-19 (July 1, 1959).

The contribution of three pions to the scalar electromagnetic form factors of the nucleon are computed by using the fixed source meson theory without rescattering corrections. The $(\gamma, 3\pi)$ interaction is taken phenomenologically as a point interaction. It is shown that for those values of the $(\gamma,3\pi)$ coupling constant compatible with photoproduction experiments, the experimental charge distribution could be roughly fitted with a cutoff in the dispersion integral of the order of 7 pion masses.

539.12

12547. MESON-THEORETICAL ORIGIN OF THE SPIN–ORBIT COUPLING BETWEEN TWO NUCLEONS.
N.Tzoar, R.Raphael and A.Klein.
Phys. Rev. Letters, Vol. 2, No. 10, 433-4 (May 15, 1959).

A rough calculation is made of the spin–orbit potential for two nucleons, using the Tamm–Dancoff method for the virtual pion–nucleon scattering taking account of recoil effects to the first order in nucleon velocity. The adjustable parameters in the Hamiltonian are chosen to fit low energy pion–nucleon phase shifts. This method is correct up to the exchange of two pions. It gives a triplet odd spin–orbit potential in qualitative agreement with Gammel and Thaler, and with Signell, Zinn and Manshak (Abstr. 7172, 7971 of 1957; 270, 2468 of 1958; 2679 of 1959) except near the core where it is too strong. For triplet even states the spin–orbit potential is reduced to 25% and reversed in sign. A.Ashmore

539.12

12548. THE MAGNETIC FORM FACTOR OF THE NUCLEON.
H.Eisenlohr and H.Salecker.
Z. Naturforsch., Vol. 14a, No. 8, 699-707 (Aug., 1959). In German.

Deals with the form factor of the anomalous magnetic moment distribution of a proton and neutron. It is first shown, with three examples, that the magnetic r.m.s. radius cannot be taken from the existing experimental data with sufficient accuracy. Satisfactory agreement with the experimental results can be obtained with arbitrary values of r_m^2. Calculations are made of the form factors depending on the energy momentum transfer q^2 in perturbation theory and the 2 π-meson contribution to the isotopic vector form factor with dispersion relations, also in relation to q^2, with and without the π-meson form factor. The shape of this form factor is in better agreement with the phenomenological factor of Hofstadter, at the expense of the static magnetic moment. But the contribution of the high q^2 values is still too large i.e. the structure is somewhat too concentrated.

539.12

12549. CALCULATION OF THE MAGNETIC MOMENTS OF NUCLEONS BY USE OF A MODIFIED PROPAGATOR.
J.L.Uretsky and P.J.Redmond.
Nuclear Phys., Vol. 12, No. 5, 485-93 (Aug. (2), 1959).

Previous attempts to use modified propagators in field-theory calculations have been frustrated by the appearance of ghost states in the propagator when one tries to improve on conventional perturbation theory. Recently a method of eliminating these ghosts has been suggested. By following this suggested procedure it is possible to calculate the magnetic moments of nucleons by using a modified nucleon propagator, which should be an improvement on simple perturbation theory without introducing any spurious infinities. This calculation has been performed approximately and yields magnetic moments of +1.2 and −2.3 nuclear magnetons for the proton and neutron, respectively, compared with the experimental values of 1.8 and −1.9. The improvement over perturbation theory is achieved because of a strong damping of the nucleon recoil term.

539.12

12550. ON THE ANNIHILATION CROSS-SECTION OF THE ANTI-NUCLEON AND THE NUCLEON. Y.Yamaguchi.
Progr. theor. Phys., Vol. 17, No. 4, 612-13 (April, 1957).

Discusses the cross-section resulting from "black sphere" interaction, with radius double that of the proton charge distribution. R.J.N.Phillips

539.12

12551. MODIFICATION OF THE EFFECTIVE-RANGE FORMULA FOR NUCLEON–NUCLEON SCATTERING.
H.P.Noyes and D.Y.Wong.
Phys. Rev. Letters, Vol. 3, No. 4, 191-3 (Aug. 15, 1959).

The usual effective-range formula for ^1S or ^3S scattering implies that the only singularities of the scattering amplitude are two poles. According to Mandelstam's representation the singularities are branch points corresponding to the thresholds for one, two, ... meson exchange. In this work the one meson branch cut is treated exactly, the others are replaced by a pole whose position and residue is fitted to low energy data. The calculation should be reliable up to 40 MeV whereas the usual effective-range formula converges only up to 10 MeV. If more branch points were treated exactly the phenomenological pole should be less important and the radius of convergence greater. D.W.L.Sprung

539.12

12552. EFFECTS OF ATOMIC ELECTRONS ON p–p AND n–p SCATTERING. II. G.Breit.
Phys. Rev. Letters, Vol. 2, No. 9, 401-2 (May 1, 1959).

Further consideration of compensation effects dealt with in a previous letter (Abstr. 1660 of 1959). W.A.Hepner

539.1

12553. POSSIBLE SETS OF EXPERIMENTS FOR A SIMULTANEOUS ANALYSIS OF DATA ON NUCLEON–NUCLEON SCATTERING AND POLARIZATION IN P–N-COLLISIONS AT 635 MeV.
B.M.Golovin, V.P.Dzhelepov, V.S.Nadezhdin and V.I.Satarov.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 433-43 (1959). In Russian.

It is suggested that analysis of data on n–p and p–p scattering be carried out simultaneously as this should reduce the number of experiments required to construct the scattering amplitude. Sets of experiments are presented which should yield sufficient information for such analysis. The angular dependence of the polarization in p–n collisions at 635 MeV was measured. A difference was detected in the energy and angular dependences of the polarization for states of a nucleon–nucleon system possessing different isotopic spins (T = 0 and T = 1).

539.1

12554. TRIPLE SCATTERING OF 660 MeV PROTONS. I. MEASUREMENT OF THE DEPOLARIZATION PARAMETER D (90°).
Yu.P.Kumekin, M.G.Meshcheryakov, S.B.Nurushev and G.D.Stoletov.
Zh. eksper. teor. Fiz., Vol. 35, No. 6,(12), 1398-401 (1958).
In Russian.

Experiments on triple scattering of 660 MeV protons are described. The depolarization parameter D (90°) was found to be equal to 0.93 ± 0.17. The result indicates that p–p scattering through an angle of 90° is mainly due to the $C(\sigma_1 + \sigma_2)n$ term in the scattering matrix.

539.1

12555. INTERPRETATION OF THE MAXIMUM IN THE TOTAL CROSS-SECTION OF PROTON–PROTON SCATTERING IN THE 1 BeV REGION. V.I.Rus'kin.
Zh. eksper. teor. Fiz., Vol. 36, No. 3, 935 (1959). In Russian.

It is shown that a tentative explanation of the maximum can be obtained by assuming that there is a resonance scattering contribution from the T = 3/2 state of the "dressed" target-nucleon. P.Roma

539.1

12556. RANGE–ENERGY RELATIONS FOR PROTONS IN Be, C, Al, Cu, Pb, AND AIR. R.M.Sternheimer.
Phys. Rev., Vol. 115, No. 1, 137-42 (July 1, 1959).

Range–energy relations for protons in these six substances were obtained. The calculations of the energy loss dE/dx include the shell corrections at low energies and the density effect which becomes important in the high-energy region. The present results can also be used to determine the range of μ-mesons up to ~ 10 BeV. Best fits to the calculated values of the ranges, tables of the ionization loss dE/dx are also presented.

539.

12557. POLARIZATION OF RECOIL PROTONS FROM THE PHOTOPRODUCTION OF π^0 MESONS FROM HYDROGEN.
P.C.Stein.
Phys. Rev. Letters, Vol. 2, No. 11, 473-5 (June 1, 1959).

The polarization of the recoil protons at 90° centre-of-mass from the reaction $\gamma + p \rightarrow p + \pi^0$ has been measured, for incident γ-energies of 550 and 700 MeV, using a carbon scatterer as analyser. The values obtained are respectively 0.30 ± 0.12 and

9 ± 0.06. These figures were derived from the data with the p of Monte Carlo calculations of the expected right—left mmetries, assuming certain proton polarizations. The 700 MeV ult agrees with the assignment of $D_{3/2}$ for the second resonance he photoproduction and the 550 MeV result indicates that the ity of the 700 MeV resonance is opposite to that of the 300 MeV onance. J.D.Dowell

539.12

58. KINEMATICS OF THE NEUTRON—DEUTERON ATTERING. T.Hamada.
gr. theor. Phys., Vol. 21, No. 6, 769-78 (June, 1959).
The kinematics of the elastic neutron—deuteron scattering is died taking into account the possible spin—orbit coupling in the ttering interaction. The investigation covers the general structure the parametrization of the scattering matrix, the differential ss-section and the polarization, and the behaviour of those para- ters characterizing the scattering matrix near zero energy. The er provides a rigorous and explicit basis for the phase-shift alysis of elastic neutron—deuteron scattering.

539.12

559. THE ELASTIC SCATTERING OF HIGH ENERGY NEUTRON DEUTERON. Y.Sakamoto and T.Sasakawa.
ogr. theor. Phys., Vol. 21, No. 6, 879-901 (June, 1959).
This has been investigated using the two-body scattering ampli- les and the deuteron wave-functions calculated making use of the son theoretical potential. It is found that (1) the impulse approxi- tion can well reproduce the experimental result of the differential oss-section in the region $\theta < \sim 90^0$ near 100 MeV neutron energy; the phase-shifts of nucleon—nucleon scattering and the deuteron ve-function derived by using meson theory may give the best fit; (3) the impulse approximation will also be expected to reproduce ll the polarization at small angles. The experiment of the polari- tion may serve as a further test for discriminating various sets of ase-shifts of nucleon—nucleon scattering.

539.12 : 539.17

ENERGY TRANSFERENCE IN NEUTRON SCATTERING. ERMAL NEUTRONS IN REACTOR FUEL ELEMENTS. See str. 11504

539.12

560. ON THE SLOWING OF NEUTRONS INTO THE eV RANGE, HYDROGENOUS SCATTERING MEDIA. P.Engelmann.
kleonik, Vol. 1, No. 4, 125-8 (Dec., 1958). In German.
When the neutrons have energies of a few eV, then the elastic llisions by which they are retarded are modified by the chemical ding of the protons in the scattering molecules. Short pulses of ergetic neutrons were directed into a lead acetate moderator; the utrons of specific energy (1.44 eV) were detected by a scintillation unter and In foil. The temporal distribution of these neutrons was asured; this showed that the energy lost by neutrons in the eV nge served mainly to excite the molecules. These results also ow that an effective mass of 2.5 can be assigned to the protons in moderator. D.H.Lord

539.12

561. THE PREPARATION OF A LARGE PLUTONIUM-ERYLLIUM NEUTRON SOURCE. K.L.Wauchope and J.Baird.
nuclear Mater., Vol. 1, No. 2, 191-5 (July, 1959).
A plutonium-beryllium alloy neutron source, containing 100 g plutonium and 68 g of beryllium, was prepared by the reduction plutonium dioxide with beryllium followed by vacuum sintering 1450°C to form a mechanically strong, non-friable compact. ne compact was sealed in a double aluminium container. Neutron tput from the source is $1.01 \pm 0.03 \times 10^7$ neutrons/sec. In reparation of the source, tongs with 25 cm handles were used in l operations after mixing of the original ingredients, to prevent rious over-exposure of personnel. The source is now in use for e calibration of neutron-counting instruments and for the irradia- on of small experimental samples.

539.12

562. AN ACCURATE PHOTO-NEUTRON STANDARD. .C.Marin.
uclear Instrum. and Methods, Vol. 5, No. 1, 26-36 (July, 1959)
An easily reproducible, RdTh—D_2O standard has been built. s calibration is based on the associated charged particle method. s photo-neutron yield was measured to an accuracy of 1.1%. After its calibration, the ionization current of the RdTh source was compared with the ionization current of a standard radium source, on a Curie chamber. The yield of any substandard can be determined, apart from small geometrical corrections, by a simple comparison of the RdTh source with the radium standard on the Curie chamber. Background neutrons from (α,n) reactions in the RdTh source contribute to 3% of the total yield. The number of neutrons emitted by the source used was determined by the recoil proton method, using an ionization chamber and by chemical integration in a manganese nitrate solution. The total yield of the standard is known to an accuracy of 1.25%.

539.12 : 537.311.33

12563. P—N JUNCTIONS OF InP AS NEUTRON DETECTORS. R.Gremmelmaier and H.Welker.
Semiconductors and phosphors (see Abstr. 9597 of 1959) pp. 363-6. In German.
Neutrons interact with In nuclei to form two radioactive isotopes. The β- and γ-radiation from the decay of these isotopes (half-lives of 13 sec and 53 min) produces electron-hole pairs in the p—n junction, and so a measurable external voltage. The decay of voltage after a dose of neutron irradiation agrees with the expected isotope half-lives. K.W.Plessner

539.12 : 530.145

MATHEMATICAL FORMULATION OF THE GELL-MANN—NISHIJIMA SCHEME FOR NEW PARTICLES. See Abstr. 11827

539.12

12564. DETERMINATION OF THE MESON—NUCLEON COUPLING CONSTANT FROM NUCLEON—NUCLEON SCATTERING. H.McManus.
Nuovo Cimento, Vol. 13, No. 1, 228-30 (July 1, 1959).
The parameters of the nucleon—nucleon scattering amplitude are calculated from the Gammel—Thaler potential. These are then extrapolated to the unphysical region of angle where, except for C, they are expected to have a simple pole corresponding to the one meson exchange. On assuming that this extrapolation is not affected by processes involving several mesons, a value for the meson—nucleon coupling constant can be found from each parameter at each energy. 32 values are given, corresponding to the extrapolation of the eight parameters at each of four energies. The mean value is in agreement with that found from other sources. The large scatter found in the values is probably due to the fact that the Gammel—Thaler potential only gives a rough fit to the actual scattering amplitude. E.J.Squires

539.12

12565. A NEW METHOD FOR THE DETERMINATION OF THE MESON—NUCLEON COUPLING CONSTANT FROM THE 33 PHASE SHIFT. A.Martin.
Nuovo Cimento, Vol. 13, No. 1, 241-3 (July 1, 1959).
By starting from the Low equation, an equation is obtained which expresses the product of the cut-off factor and the coupling constant in terms of the 33 phase shift and an unknown function. The latter is approximated and seen to be not very important. Hence, by extraploating to zero total energy of the meson, where it is reasonable to assume the cut-off factor is equal to 1, it is possible to obtain the coupling constant. A value of $f^2 = 0.099 \pm 0.003$ is obtained. This is larger than the value obtained from dispersion relations. E.J.Squires

539.12

12566. PROBLEMS OF MULTIPLE PARTICLE EMISSION. G.Domokos.
Acta phys. Hungar., Vol. 10, No. 1, 7-17 (1959).
The qualitative features of the process of multiple meson production are discussed. A possible qualitative model is established for the description of events of this kind. Some measurements are proposed in order to clarify further the characteristics of the process.

539.12

12567. DECAY RATE AND SPECTRUM OF ELECTRONS FROM μ^--MESONS OF THE K-SHELL. L.Tenaglia.
Nuovo Cimento, Vol. 13, No. 2, 284-91 (July 16, 1959).
The decay rate of a μ^--meson from the K-shell of a light nucleus is evaluated as a function of the momentum of the produced electron and of the atomic number, taking into account the main electrostatic corrections on the usual, plane wave eigenfunctions of

the electron, by a Born-like approximation. Such corrections change appreciably the decay rate and the shape of the spectrum (mainly, its lowest part) of the emitted electrons.

539.12

12568. MESON DECAYS AND STRUCTURE OF MUON. M.Taketani, Y.Katayama, P.Leal Ferreira, G.W.Bund and P.R.de Paula e Silva.
Progr. theor. Phys., Vol. 21, No. 6, 799-817 (June, 1959).

Considering the peculiar position of the muon among the elementary particles, it seems reasonable to assume an inner structure for this particle. The determination of the structure of the muon now seems experimentally possible, and the authors consider theoretically how to determine it through the various decay processes. The analyses proposed are mainly connected to pion and muon decay problems. Assuming the so-called universal Fermi interaction, with V and A couplings, by which the decay processes are realized, the considerations are restricted to the behaviours of the non-local form factor which arise from the muon structure. Also possibilities of the electron structure are discussed. The analysis sensitively depends on the deviation of the asymmetry parameter. Its deviations from the original local value must be within about 6%, and a value larger than this cannot be explained without considerations of the electron structure and some other sources.

539.12 : 539.17

12569. THEORETICAL CALCULATIONS ON $\mu^- + {}^{12}C \rightarrow {}^{12}B + \nu$. L.Wolfenstein.
Nuovo Cimento, Vol. 13, No. 2, 319-25 (July 16, 1959).

Theoretical calculations of the capture rate and possible observations on the recoiling nucleus have been made for the process $\mu^- + C^{12} \rightarrow B^{12} + \nu$. The basic interaction for μ-meson capture is assumed to be the same as that in β-decay. Virtual pion effects which are included with and without the assumption of a conserved vector current, are difficult to observe because of the theoretical uncertainty as to the magnitude of the second forbidden contributions.

539.12

12570. SCATTERING OF μ-MESONS IN LEAD. A.I.Alikhanyan and F.R.Arutyunyan.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 32-40 (1959). In Russian.

The scattering of μ-mesons possessing momenta between 1.0 and 1.8×10^8 eV was studied in 7 mm thick lead plates. The experimental angular distribution is compared with the theoretical multiple scattering curve which takes into account the finite nuclear dimensions. It is shown that after introduction of all relevant corrections the experimental results satisfactorily agree with the calculations.

539.12

12571. SCATTERING OF μ-MESONS WITH MOMENTA OF ABOUT 100 MeV/c IN COPPER AND IRON. V.G.Kirillov-Ugryumov, B.A.Dolgoshein, A.M.Moskvichev and L.P.Morozova.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 416-23 (1959). In Russian.

The scattering was investigated in copper plates (in the μ-meson momentum interval from 85 to 144 MeV/c), and in iron plates (μ-meson momenta from 81.2 to 135 MeV/c). The μ-meson angular distribution plotted on basis of 2350 scattering events satisfactorily agrees with the distribution for a point nucleus.

539.12

12572. ON TRAVERSAL OF MATTER BY HIGH ENERGY μ-MESONS. I.L.Rozental' and V.N.Strel'tsov.
Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1440-6 (1958). In Russian.

The traversal of thick layers of matter by high-energy μ-mesons is considered taking account of ionization losses, bremsstrahlung, emission of pairs and "star" production. The distributions of the energy losses are taken into account for the last three processes. It is shown that account of the distribution functions leads to a decrease of the μ-meson flux at sea level computed on basis of the mean energy losses.

539.12 : 539.18

HYPERFINE SPLITTING EFFECTS IN THE CAPTURE OF POLARIZED μ-MESONS. See Abstr. 11516

539.12

12573. MUON DEPOLARIZATION IN HIGH ENERGY MUON–ELECTRON SCATTERING. A.Deloff and R.Gajewski.
Bull. Acad. Polon. Sci. Ser. Sci. math. astron. phys., Vol. 6, No. 12. 775-9 (1958).

The formalism of Bouchiat and Michel (Abstr. 5189/1958) is used to calculate the change of polarization of high-energy muons, resulting from their collision with electrons. The results are used to estimate the contribution of depolarization originating from muon–electron scattering to the total depolarization of muons passing through a layer of matter. G.Martel

539.12 : 539.18

12574. DEPOLARIZATION OF μ^--MESONS BY THE FORMATION OF μ-MESIC ATOMS. I.M.Shmushkevich.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 645-6 (Feb., 1959). In Russi

A theoretical analysis of the process leads to the conclusion th the average polarization of μ^--mesons in the K-shell should be $\frac{1}{3}$. in approximate agreement with experimental findings. P.K.Kabi

539.1

12575. A METHOD OF STUDYING THE ELECTROMAGNETIC PROPERTIES OF THE CHARGED π-MESON. L.Goldzahl, B.Jouvet, M.Mathieu and J.Poyen.
C.R. Acad. Sci. (Paris), Vol. 249, No. 1, 88-90 (July 6, 1959). In French.

The possibility of using the production of knock-on electrons b charged pions of 10-20 GeV to study some properties of the pion is discussed. It is suggested that a possible structure of the pion can be discovered by comparing the experimentally observed productic cross-section of knock-on electrons with the theoretical value at four momentum transfers of about 10^{-13} cm. Measurement of the knock-on cross-section would also furnish a method of establishing directly the spin of the pion. E.G.Michael

539.

12576. RADIATIVE CORRECTIONS TO π—e DECAY. T.Kinoshita.
Phys. Rev. Letters, Vol. 2, No. 11, 477-80 (June 1, 1959).

Electromagnetic corrections to the electronic decay of π-mesons are calculated, taking into account the probability of an inner-bremsstrahlung process and of virtual photon emission and reabsorption. J.D.Dow

539.

12577. INVESTIGATION OF $\pi^+ - \mu^+ - e^+$-DECAY USING A PROPANE BUBBLE CHAMBER AND SCINTILLATION COUNTERS M.P.Balandin, V.A.Moiseenko, A.I.Mukhin and S.Z.Otvinovskii.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 424-32 (1959). In Russian.

The angular distributions of μ^+-mesons and positrons from $\pi^+ - \mu^+ - e^+$-decays were investigated. It was found that the angul distribution of the μ^+-mesons is isotropic, whereas the positron angular distribution, if described by the expression $(1 - a \cos$ is characterized by the quantity $a = 0.116 \pm 0.035$. This value for a is much smaller than the values obtained in other experiments i which propane bubble chambers were also employed. Scintillation counter experiments, carried out to ascertain the cause of this discrepancy, showed that the magnitude of the anisotropy significa depends on the degree of purification of the commercial propane which is sometimes employed in bubble chambers. A simultaneou analysis of the data obtained with propane of a given composition showed that the quantity $\lambda(1 - W_C)$ is equal to 0.78 ± 0.26, where W is the probability for depolarization of μ^+-mesons in graphite and λ is a fundamental parameter in neutrino theory.

539.

12578. MEASUREMENT OF THE π^0 MASS, AND SEARCH FOR A π_0^0. M.Gettner, L.Holloway, D.Kraus, K.Lande, E.Leboy, W.Selove and R.Siegel.
Phys. Rev. Letters, Vol. 2, No. 11, 471-3 (June 1, 1959).

A time of flight method was used to select the neutrons from the reactions following π^- capture at rest in liquid hydrogen. Usi a flight path of 3 ft a group was found corresponding to the reactic $\pi^- + p \rightarrow n + \gamma$. The flight path was reduced to 2 ft to enable the group from the alternative reaction, $\pi^- + p \rightarrow n + \pi^0$ to be distingu from the background. This group gave for the mass difference, $m_{\pi^-} - m_{\pi^0} = (9.0 \pm 0.3)\, m_e$. There was a slight indication of a further group corresponding to a π_0^0 about 0.65 m_e heavier than th π^0 but this has still to be confirmed. From the sharpness of the π mass shown by the date a lower limit of 3×10^{-21} sec can be plac on its lifetime. A.Ashm

539

12579. CHARGE RADIUS OF PION. Riazuddin.
Phys. Rev., Vol. 114, No. 4, 1184-6 (May 15, 1959).

Using a dispersion relation for Compton scattering of virtual ons on pions, the charge radius of the pion is analysed in terms f π—π^0 mass difference. It is found to be of the order of nitude 0.46×10^{-13} cm to 0.56×10^{-13} cm.

539.12

0. INTERPRETATION OF RESONANCE ENERGIES IN THE TOPRODUCTION AND SCATTERING OF PIONS FROM ROGEN. K.M.Guggenheimer.
re (London), Vol. 183, 1758-9 (June 20, 1959).
Observed resonances at 263 MeV, 299 MeV, 574 MeV and MeV (in the centre of mass system) for scattering and photo-duction of pions in hydrogen are interpreted in terms of a level me derived from an energy formula for heavy fermions $= 38.46\,[l(l+1) + s(s+1)]$ MeV. Possible excitations from a nerate state of the core particle at 798 MeV (obtained by taking , $S = 5/2$ or $l = 4$, $S = \frac{1}{2}$) are considered, and good agreement the experimental excitation energies obtained. An alternative anation for the resonances at either 263 or 299 MeV in terms air creation, is provided by the fact that 270 MeV is the rest gy of a pair of neutral pions and 279 MeV that for a pair of ged pions. Production of particle pairs with $l = 2$, $s = \frac{1}{2}$ and $l = 2$, 5/2 explains observed resonances at 543 MeV and 775 MeV e photoproduction of positive pions and the scattering of ative pions, respectively. The rest energy of 211 MeV for a n pair leads to an expected maximum in pion scattering at MeV (lab system) and 235 MeV (lab system) for γ-rays producing s. Anomalies seem to have been observed in these energy ions. R.E.Meads

539.12

31. PRELIMINARY RESULTS REGARDING HIGH ENERGY ERACTIONS OF π^- IN A He-BUBBLE CHAMBER.
Block, B.Brucker, C.Chang, T.Kikuchi, C.Meltzer, F.Anderson, evsner, H.Cohn, E.Harth, J.Leitner, G.Brauiti, C.Franzinetti R.Tosi.
ovo Cimento, Vol. 12, No. 6, 642-3 (June 16, 1959).
Interactions of 1.1, 1.8 and 2.4 GeV/c negative pions with ium have been studied in the Duke University liquid-helium ble-chamber with the aim of determining the relative and olute parities of K^+ and K^0. Preliminary results give a value 10 mb for the total interaction cross-section of 1.8 GeV/c ative pions. The cross-sections for elastic scattering and for production are respectively about 5 and 1 mb. From the first raction minimum of the scattering distribution a value of 10^{-13} cm is obtained for the nuclear radius of He. The total eraction cross-section of 1.1 GeV/c negative pions on helium bout 135 mb. E.G.Michaelis

539.12

82. ACCOUNT OF RESONANCE π—π-INTERACTION WITHIN E FRAMEWORK OF FERMI'S STATISTICAL THEORY OF LTIPLE PRODUCTION OF PARTICLES. V.I.Rus'kin.
eksper. teor. Fiz., Vol. 36, No. 1, 164-8 (1959). In Russian.
An attempt is made to take into account the resonance inter-ion between two π-mesons on basis of Fermi's statistical theory. e concrete case of π^-—p-scattering at an energy of 4.5 MeV is sidered. Production of strange particles is taken into account. e results are compared with the experiments.

539.12

83. SCATTERING OF π^--MESONS IN HYDROGEN AT ENERGIES 0 MeV, 270 MeV. V.G.Zinov and S.M.Korenchenko.
eksper. teor. Fiz., Vol. 36, No. 2, 618-19 (1959). In Russian.
The experimental differential cross-sections obtained on a fluid drogen target are tabulated, for the elastic- and exchange-scatter-gs. Assuming contributions only from S and P waves, the three efficients of the angular distribution are also calculated.
P.Roman

539.12

84. PHOTOPRODUCTION OF NEUTRAL PIONS ON HYDRO-EN NEAR THE THRESHOLD.
I.Goldansky, B.B.Govorkov and R.G.Vassilkov.
clear Phys., Vol. 12, No. 4, 327-32 (Aug. (1), 1959).
The angular distribution of π^0-mesons produced on protons is died near the threshold for γ-ray energies of 160-220 MeV. The tribution can be represented by the formula

$$\frac{d\sigma}{d\Omega} = A + B\cos\theta + C\cos^2\theta,$$

which corresponds to creation of π^0 mesons in the S- and P-states. Absolute values of the coefficients A, B, C in the indicated energy region are presented. The experimental values of B/A and C/A are compared with the theoretical formulae of Watson and Feld. The ratio of the cross-sections for photoproduction of π^+ and π^- mesons near the threshold has been derived from the value of the γ-ray energy corresponding to $B = 0$ (260^{+20}_{-10} MeV) and on the basis of data on π-meson—nucleon scattering. The ratio thus found is $\sigma_+/\sigma_- = 1.30 \pm {}^{0.19}_{0.05}$.

539.12

12585. PHOTO PRODUCTION OF PION PAIRS BY A NUCLEON.
S.K.Srinivasan and K.Venkatesan.
Nuclear Phys., Vol. 12, No. 4, 418-25 (Aug. (1), 1959).
Double photoproduction of pions by nucleons is examined on the basis of the "fixed extended" source theory of Chew and Low. A linear integral equation for the matrix element is derived using the Tamm—Dancoff approximation. Using the solution of Chew and Low for single production, an expression for the cross-section of the process is obtained as a first approximation. The total cross-section compares favourably with the experimental results of Sellen, Cocconi and Hart (Abstr. 6155 of 1958).

539.12

12586. THREE-BODY DECAYS OF K_2^0 AND K_1^0.
F.S.Crawford, Jr, M.Cresti, R.L.Douglass, M.L.Good, G.R.Kalbfleisch and M.L.Stevenson.
Phys. Rev. Letters, Vol. 2, No. 8, 361-3 (April 15, 1959).
Nine bubble-chamber events are discussed. They are consistent with equal leptonic decay rates for K_1^0 and K_2^0, and with the extended $\Delta I = \frac{1}{2}$ rule. A new value for the K_2^0 lifetime is found.
R.J.N.Phillips

539.12

12587. K^0—K^+ MASS EXCESS. Riazuddin.
Nuclear Phys., Vol. 12, No. 4, 342-8 (Aug. (1), 1959).
An attempt is made to explain the recently measured K^0—K^+ mass difference (Abstr. 6038 of 1959) in terms of the self-energies of the K-mesons due to K–baryon interaction. Two cases are considered: (1) K^0—K^+ relative parity is assumed to be odd and there arises a non-electromagnetic mass split; (2) K^0—K^+ relative parity is taken to be even and the doublet nature of K is maintained: the mass difference for this case is calculated via the renormalization of K–baryon coupling constants due to electromagnetic field. It is shown that in either case K^0 may be heavier than K^+. Both cases favour pseudoscalar K^+ with respect to ΛN and ΣN systems. But while case (1) (with pseudoscalar K^+) favours even Ξ—N relative parity, the opposite holds for case (2). Further, for case (1), scalar K^+ together with odd Ξ—N relative parity is also possible.

539.12

12588. K^--MESON PARITY FROM THE REACTION $K^- + d \rightarrow \Lambda^0 + p + \pi^-$. R.Stroffolini and G.Varcaccio.
Nuovo Cimento, Vol. 13, No. 2, 249-56 (July 16, 1959).
The possibility of determining the product parity of K^- and Λ^0 relative to the nucleon from the reaction $K^- + d \rightarrow \Lambda^0 + p + \pi^-$ is discussed. The considerable difference between triplet and singlet Λ^0—nucleon interactions allows predictions, for the spectrum of the Λ^0—p relative energy, rather strongly depending on the assumed K^-—Λ^0 relative parity.

539.12

12589. K^-, $\bar{K}^0$ RELATIVE PARITY AND THE K^-—d CHARGE EXCHANGE REACTION. T.B.Day, G.A.Snow and J.Sucher.
Nuovo Cimento, Vol. 13, No. 3, 614-27 (Aug. 1, 1958).
The reaction $K^- + d \rightarrow \bar{K}^0 + 2n$ is studied in the hope that limitations on the final states for the two neutrons due to statistics will help differentiate between even and odd relative parity of the K^- and $\bar{K}^0$ mesons. The total cross-section for the reaction is calculated in the impulse approximation, and expressed in terms of the corresponding hydrogen cross-section for both even and odd parity. The calculations are carried out (a) with the use of antisymmetrized plane waves for the two neutrons, and (b) in the closure approximation. The ratio of the odd to even parity cross-sections is about a factor of two in either approximation. The total cross-section for odd parity in the plane wave approximation is found to be about 4 mb at a K^- laboratory momentum of 136 MeV/c.

539.12

12590. K–π INTERACTIONS AND K^+–N SCATTERING. S.Minami.
Progr. theor. Phys., Vol. 17, No. 3, 508-10 (March, 1957).

Discusses the role of the π–K interaction in K–N scattering.
R.J.N.Phillips

539.12

12591. ON THE INTERACTION BETWEEN K- AND π-MESONS.
V.I.Ogievetskii.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 642-3 (1959). In Russian.

In order to check the existence of the interaction

$$f/2m_K\,(\bar{K}^-K^0\pi^+ + \bar{K}^0K^+\pi^-)$$

proposed by Pais (Abstr. 3792 of 1959), it is proposed to study the reaction $\pi^- + p \rightarrow K^- + K^0 + p$. In particular, it is shown that in a certain coordinate system the angular distribution of the K-mesons ought to be (approximately) isotropic. P.Roman

539.12

12592. K^-–HYDROGEN CHARGE-EXCHANGE SCATTERING.
P.Eberhard, A.H.Rosenfeld, F.T.Solmitz, R.D.Tripp and M.B.Watson.
Phys. Rev. Letters, Vol. 2, No. 7, 312-13 (April 1, 1959).

45 examples of $K^- + p \rightarrow K^0 + n$ in a hydrogen bubble chamber exposed to K^--mesons of 6 different momenta, 130-410 MeV/c, were insufficient to distinguish between the S-wave zero-effective-range theory and that of Pais with $\lambda = -1$. E.J.Burge

539.12

12593. POSSIBLE METHODS FOR THE DETERMINATION OF STRANGE-PARTICLE PARITIES. A.Sirlin and R.Spitzer.
Phys. Rev. Letters, Vol. 3, No. 2, 110-11 (July 15, 1959).

The reaction $K^- + d \rightarrow Y + N$ is considered assuming that capture occurs predominantly from bound s-states. The correlation between the components of spins of Y and N gives the K parity. The reaction $\Sigma^\pm + He_4 \rightarrow {}_\Lambda He^5 + \pi^\pm$ is considered as a possible means of determining the relative Λ–Σ parity. C.J.Batty

539.12

12594. ON THE ELASTIC SCATTERING OF LOW ENERGY K^- ON PROTONS. D.Amati, E.Galzenati and B.Vitale.
Nuovo Cimento, Vol. 12, No. 6, 627-9 (June 16, 1959).

Using the relativistic dispersion relations for D_+ and D_-, the real parts of the scattering amplitudes of K^+ and K^- mesons on protons, which were derived in a previous paper (Abstr. 1201 of 1958) a new relation is obtained which connects D_- with the relative K–Λ and K–Σ parities and the total cross-sections of K^+ and K^- on protons. D_- is used to calculate the elastic scattering cross-section on protons as a function of energy, and satisfactory agreement with experiment is found by assuming that the K meson is pseudoscalar with respect to Λ and Σ. The observed maximum of the elastic scattering cross-section at 30 MeV is accounted for without introducing any further hypothesis. E.G.Michaelis

539.12

12595. K^-–p SCATTERING AT LOW ENERGY. S.Minami.
Nuovo Cimento, Vol. 13, No. 2, 354-62 (July 16, 1959).

The experimental results obtained by Glasser et al. are analysed in a phenomenological way. One conclusion is that the experimental results for K^-–p scattering at low energy can be explained by taking account of the effects of absorption, even if the values of phase shifts are not so large. Moreover, whether the phenomenological analysis worked out by Ascoli et al. is reasonable or not is discussed.

539.12

12596. K^+-MESON–NUCLEON SCATTERING AND K^+–Y RELATIVE PARITY. L.K.Pandit and S.N.Biswas.
Nuclear Phys., Vol. 12, No. 5, 521-6 (Aug. (2), 1959).

A covariant integral equation in the ladder approximation has been set up for the Feynman amplitude describing the K^+-nucleon scattering through a strong direct K–Y–N interaction. The two possibilities of the relative K–Y parities have been considered, it being assumed that both K^0 and K^+ have identical parity. The equation has been solved by the Fredholm method employing the prescription of McCarthy and Green (Abstr. 8918 of 1954) to obtain a divergence-free solution. The present calculations favour even relative K–Y parity. For the best fit with (K^+–p) scattering experiments, the coupling constants required are $G_{NK\Lambda} = \sqrt{3}G_{NK\Sigma}$, $G^2_{NK\Sigma}/4\pi = 0.5$.

539.1

12597. DOUBLE SCATTERING OF RELATIVISTIC π-MESONS ON NUCLEONS. V.A.Astaf'ev.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 98-107 (1959). In Russian

The double scattering theory based on invariance of the interaction Hamiltonian under rotation in isotopic and x-space is extended to relativistic energies. The expression for the differential cross-section was obtained in a form which is convenient for analysis of the experimental data. To illustrate application of the formal theory the problem of the approximation of radiation damping is considered.

539.12 : 539.14

LOW-ENERGY APPLICATION OF RELATIVISTIC K-MESON–NUCLEON DISPERSION RELATIONS. See Abstr. 1061

539.12 : 530.14

THE DETERMINATION OF THE PARITIES OF HYPERONS AN K-MESONS. See Abstr. 11797

539

12598. SCATTERING OF Λ^0 HYPERONS BY NUCLEONS AT INTERMEDIATE ENERGIES. J.S.Kovacs and D.B.Lichtenberg.
Nuovo Cimento, Vol. 13, No. 2, 371-5 (July 16, 1959).

A calculation is made of the scattering cross-section at 75 an 150 MeV laboratory energies, based on a phenomenological centra potential with a hard core to describe the Λ^0–nucleon interaction. The potential is chosen so as to give agreement with hyperfragmen data and at the same time to have reasonable properties from a meson-theoretical viewpoint. With this potential the Λ^0–nucleon cross-section is calculated numerically, assuming that scattering occurs only in states with orbital angular momentum ≤ 2. The result is that the Λ^0–nucleon cross-section is approximately constant in the energy range considered. The variation is from 26 m at 75 MeV to 21 mb at 150 MeV without a spin–orbit force, and fr 34 mb at 75 MeV to 32 mb at 150 MeV with a spin–orbit force. These results are consistent with the preliminary measurement o of Crawford et al.

539.1

12599. INTERACTION OF ANTILAMBDA HYPERONS WITH NUCLEONS AT INTERMEDIATE ENERGIES.
J.S.Kovacs and D.B.Lichtenberg.
Nuovo Cimento, Vol. 13, No. 2, 376-80 (July 16, 1959).

Cross-sections for the scattering and annihilation of anti-hyperons by nucleons are calculated at 75 and 150 MeV laboratory energies. The model of the anti-Λ^0–nucleon interaction is an attra tive potential at large interparticle separations and a black absorp tive hole at separations less than ~ 0.4 fermis. The cross-sectio are obtained both with and without a spin–orbit term in the potent The outer part of the potential is taken to be the same as the outer part of the Λ^0–nucleon potential required to fit the binding energie of the Λ^0 in hyperfragments. This form for the outer region follow from the assumption that this part of the potential arises from the exchange of two pions. The results indicate that about one anti-Λ^0 in 50 will interact with a nucleon in a hydrogen bubble chamber at 150 MeV the others decaying in flight. There are as yet no experi mental data with which to compare the calculated cross-sections.

539

12600. POLARIZATION EFFECTS IN THE CAPTURE OF THE Σ^--HYPERON BY THE DEUTERON.
S.G.Matinyan and O.D.Cheishvili.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 212-15 (1959). In Russian

Absorption of the Σ^--hyperon by a deuteron with formation of Λ^0-particle is examined phenomenologically. A study of the polar tion correlations of these particles yields some definite informati on the polarization of the Σ^--hyperon.

539

12601. NEUTRAL CASCADE HYPERON EVENT. L.W.Alvarez, P.Eberhard, M.L.Good, W.Graziano, H.K.Ticho and S.G.Wojcicki
Phys. Rev. Letters, Vol. 2, No. 5, 215-19 (March 1, 1959).

Seven double V^0 events and 500 single V^0 events were record in a 15 inch hydrogen bubble chamber exposed to a total of 10^5 K^- mesons of momentum (1.15 ± 0.02) BeV/c. Six of the double V^0 events were clear cases of associated production by the 13% π^- co tamination. The remaining event involved the production of a K^0 which decayed into a π^+ and a π^-. A nearby $\Lambda^0 \rightarrow p + \pi^-$ was 7° o

coplanarity with the end of the K^-, and the most probable interpretation is that it arose from the decay (after 1.5×10^{-10} sec) of a produced in association with the K^0. This gives a Ξ^0 mass of 1 ± 8 MeV. E.J.Burge

539.12

02. Λ^0 AND Σ^0 PRODUCTION FROM THE (Σ^-,d) SYSTEM. .Day, G.A.Snow and J.Sucher.
s. Rev. Letters, Vol. 2, No. 11, 468-70 (June 1, 1959).
The ratio of Λ^0 to Σ^0 production in the absorption of Σ^- ticles in deuterium is calculated, using the experimental value he same ratio for absorption in hydrogen. It is assumed that the ture always takes place in S orbits, that the relative parity of Σ^0 and Λ^0 are even, and that the final state interaction can be lected. For a value of the Σ^-, Σ^0 mass difference of greater n about 6 MeV it is possible to obtain agreement with experiment. Any enhancement of the Λ^0 production, similar to that which sts for K^- absorption in deuterium, would make agreement der to obtain. E.J.Squires

539.12

603. ONE-MESON CONTRIBUTION TO THE DEUTERON ADRUPOLE MOMENT. D.Y.Wong.
ys. Rev. Letters, Vol. 2, No. 9, 406-7 (May 1, 1959).
It is shown that the quadrupole moment of the deuteron can gely be accounted for by a one-meson exchange contribution to nucleon–nucleon force. The theoretical value obtained is within % of the experimental one. J.D.Dowell

539.12 : 539.17

604. THE POLARIZATION OF DEUTERONS AND PARTICLES ARBITRARY SPIN. II. L.J.B.Goldfarb and J.R.Rook.
clear Phys., Vol. 12, No. 5, 494-509 (Aug. (2), 1959).
For Pt I see Abstr. 1761 (1959). General formulae are given r the polarization of charged particles of arbitrary spin emitted an elastic scattering process in the neighbourhood of an isolated sonance, taking into account the specific Coulomb and potential ntributions. These formulae also apply to the angular distribuns associated with incoming polarized particles. The results are pressed in terms of the channel-spin and total angular-momentum presentations. Application is made to the elastic scattering of uterons by He^4 at the deuteron laboratory energy of 1.069 MeV. evious estimates of the polarization based on consideration of ly resonance scattering require modification, particularly at low gles. Large values are found for the vector polarization which ise solely from the interference between resonance and nonsonance scattering.

539.12

605. SCATTERING OF 29.2 MeV He^3 NUCLEI BY DEUTERONS. .C.McKee, D.R.Sweetman, P.V.March, W.T.Toner, and W.M.Gibson.
ys. Rev., Vol. 115, No. 1, 143 (July 1, 1959).
Differential cross-sections for He^3 particles elastically scattered from deuterium are presented for angles from 10^0 to 40^0 (lab). oss-sections obtained previously for the same process are also own, and there is good general agreement between the two sets of sults.

539.12

606. α-PARTICLES STRAGGLING IN MICA AND ALUMINUM. .Demichelis.
uovo Cimento, Vol. 13, No. 3, 562-71 (Aug. 1, 1959).
For mica the experimental values agree reasonably well with e theoretical values obtained by applying the Livingston and ethe formula; for aluminium the experimental values differ eatly from the theoretical ones.

NUCLEUS

539.14

607. NUCLEON–NUCLEON SPIN–ORBIT INTERACTION OTENTIAL. M.H.Hull, Jr, K.D.Pyatt, Jr, C.R.Fischer and G.Breit.
hys. Rev. Letters, Vol. 2, No. 6, 264-6 (March 15, 1959).
Discusses the agreement between various potentials suggested r the nucleon–nucleon interaction and the experimental data, with articular reference to the spin–orbit potential. Potentials of the gnell–Marshak type are discussed, and it is shown that these all disagree violently with some aspects of the available data. E.J.Squires

539.14

12608. ON THE STABILITY OF NUCLEI. P.É.Nemirovskii.
Zh. eksper. teor. Fiz., Vol. 36, No. 3, 889-95 (1959). In Russian.
The dependence of the interaction between a nucleon and the nucleus on N/Z is investigated. An estimation of the maximal A/Z is given; this ratio is found to vary between 3 and 3.8. It is shown that when N equals the number of neutrons in a closed shell the minimal Z discontinuously changes by several units. It is suggested that these jumps in the values of Z_{min} upon closure of the neutron shell may be responsible for the considerable abundance of certain isotopes providing that the synthesis of atomic nuclei occurred in brief neutron bursts.

539.14

12609. THE STATISTICAL MODEL OF NUCLEI WITH ANGULAR MOMENTUM. D.Kisdi.
Acta phys. Hungar., Vol. 10, No. 1, 29-38 (1959).
The critical angular momentum is determined as the function of the mass number.

539.14

12610. A SHELL MODEL CALCULATION WITH REACTION MATRIX. M.K.Banerjee and B.Dutta Roy.
Ann. Phys. (New York), Vol. 7, No. 4, 484-503 (Aug., 1959).
While explaining the success of the shell model of the nucleus, the Brueckner theory of nuclear many body problem prescribes that the reaction matrix should be used in setting up the shell model Hamiltonian. The theory shows how the reaction matrix between two nucleons inside a nucleus can be calculated if the interaction potential between two free nucleons is known. So far no shell model calculation has been performed with such a reaction matrix, mainly because its evaluation in a finite nucleus is an extremely laborious task. In this paper, an approximate form for the reaction matrix has been used to calculate the level spacings of Ca^{42}. The reaction matrix has been parametrized with two quantities. One is the correlation length and the other is a quantity related to the effective mass. Reasonable agreement between the experimentally measured level spacings and the theoretical values are obtained for values of the two parameters which are consistent with the estimates of these quantities based on the studies of the properties of nuclear matter.

539.14

12611. ON THE VIBRATIONAL SPECTRUM OF THE Cd^{114} NUCLEUS. R.Arvieu.
C.R. Acad. Sci. (Paris), Vol. 248, No. 10, 1502-4 (March 9, 1959). In French.
Bohr's collective Hamiltonian and coupling term are supplemented by an interaction of the type $\delta(r_1-r_2)$ for the two proton holes of the shell $g_{9/2}$. Weak coupling is assumed. Qualitative agreement is obtained. J.Lascoux

539.14

12612. STATISTICAL DERIVATION OF THE NUCLEAR ROTATIONAL ENERGIES. K.Kumar.
Nuovo Cimento, Vol. 13, No. 3, 591-604 (Aug. 1, 1959).
The nucleus is treated as a Fermi gas under the constraint of a given angular momentum I. Its energy is expressed as a power series in I^2, and the rotational and rotation–vibration interaction terms are identified. The interparticle interactions do not influence the rotational energies whereas they have important influence on the rotation–vibration energies. Several models for angular momentum production are considered. The experimental trend of the moments of inertia is reproduced by a model in which only nucleons outside a certain "core" produce the total angular momentum. The vibrational frequency is insensitive to such models. The surface effects and the influence of velocity dependent forces are also taken into account.

539.14

12613. ON γ-VIBRATIONS OF THE SURFACE OF THE ATOMIC NUCLEUS. A.S.Davȳdov and D.A.Zaikin.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 233-7 (1959). In Russian.
The energy and probability of excitation of γ-vibrations of the surface of an atomic nucleus are computed on basis of the shell model, an anisotropic harmonic oscillator potential being assumed. It is shown that in order of magnitude the energy of the first excited state of this type is close to that of single nucleon excitations and

that the propability of excitation of these states is much smaller than the probability of excitation of rotational states in the nucleus.

539.14 : 539.17

MOMENTUM DISTRIBUTION OF NUCLEONS IN THE NUCLEAR SURFACE. See Abstr. 11465

539.14

12614. C^{14}–N^{14} DIFFERENCE AND MASS EXCESSES OF SOME LIGHT NUCLIDES. L.Friedman, W.Henkes and D.Christman.
Phys. Rev., Vol. 115, No. 1, 166-9 (July 1, 1959).

Mass excesses of the nuclides H^1, D^2, C^{12}, C^{14}, N^{14}, O^{16}, and A^{40} were determined by measurement of 18 parent molecule ion doublets with the mass synchrometer. The C^{14}–N^{14} difference, 156.44 ± 0.29 keV, was obtained from measurements on the doublets $[C^{14}O^{16}$-$O_2]$, $[N^{14}O^{16}$-$O_2]$, $[C^{14}H_4$-$H_2O]$, $[C^{14}CH_2CO]$, and $[N_2H_4$-$O_2]$ and other doublets which give some of those above. This is in excellent agreement with the value of 156 ± 1 keV obtained from determination of the C^{14} beta end point. The consistence of these data supports the 1 keV upper limit for the neutrino rest mass derived from the H^3–He^3 mass difference and the H^3 beta end point, and also supports the argument that mass synchrometer data are essentially free of systematic errors of the magnitude required to account for discrepancies between nuclear reaction and mass spectrographic mass excesses of C^{12} and O^{16}. Mass excesses of the light nuclides determined were slightly higher than recently published mass synchrometer data but agreement was generally within 1 μMU.

539.14

12615. STATISTICS OF SLOW-NEUTRON "NEGATIVE" ENERGY RESONANCES. P.A.Egelstaff.
Phys. Rev., Vol. 115, No. 1, 182-4 (July 1, 1959).

Neutron cross-sections measured with very slow neutrons often reveal the influence of levels below the neutron binding energy. The published data on 20 isotopes are analysed in such a way that the properties of the levels below and above the binding energy may be compared. It is found, in particular, that the neutron-width and level-spacing distributions for these (– and +) levels are the same within the limits of the present analysis.

539.14

12616. NUCLEAR MAGNETIC MOMENT AND SPIN OF EUROPIUM-152 m. V.W.Cohen, J.Schwartz and R.Novick.
Phys. Rev. Letters, Vol. 2, No. 7, 305-7 (April 1, 1959).

An atomic beam magnetic resonance experiment was performed to distinguish between the 0 and 1 spin assignments for Eu^{152m}. The results, together with those of other authors, which are discussed, point convincingly to a spin 0. See also following abstract.

J.D.Dowell

539.14

12617. EVIDENCE CONCERNING THE SPIN AND PARITY OF Eu^{152m}. L.Grodzins and A.W.Sunyar.
Phys. Rev. Letters, Vol. 2, No. 7, 307-9 (April 1, 1959).

Evidence, from four distinct types of experiments, concerning the spin-parity of Eu^{152m}, is summarized. The experimental results are derived from a study of: (1) the isomeric transition to the ground state; (2) the shapes of β^+ and β^- transitions; (3) the nuclear magnetic moment, and (4) β–γ correlations. All of the experiments are compatible with a spin-parity of 0^-.

J.D.Dowell

539.14 : 538.2

NUCLEAR ORIENTATION OF COBALT-60 IN ANTIFERROMAGNETIC $Co(NH_4)_2(SO_4)_2.6H_2O$. See Abstr. 12462

539.14

12618. DETERMINATION OF THE DIPOLE MOMENT AND ISOTOPE SHIFT OF RADIOACTIVE Hg^{197} BY "DOUBLE RESONANCE". A.C.Melissinos.
Phys. Rev., Vol. 115, No. 1, 126-9 (July 1, 1959).

Paramagnetic resonance was established between m-sublevels ($\Delta m = \pm 1$, $\Delta F = 0$) of the $^3P_1$ state of radioactive Hg^{197} at 3000 Mc/s. From these data the nuclear interaction constant A was found to be $(513.5 \pm 1) \times 10^{-3}$ cm^{-1}, and barring h.f.s. anomalies it lead to a ratio of moments $\mu_{197}/\mu_{199} = A_{197}/A_{199} = 1.045$; further, the nuclear spin of Hg^{197} was ascertained to be $\frac{1}{2}$. The double resonance was combined with magneto-optic scanning to give the isotope shift of Hg^{197}, which was found to be in the 2537 A line $+(91 \pm 5) \times 10^{-3}$ cm^{-1} from Hg^{198}. The radioactive mercury was produced by the $Au^{197}(d,2n)Hg^{197}$ reaction and used in vapour form. Satisfactory signals were obtained with as few as 3×10^{12} atoms.

539.

12619. DIPOLE AND QUADRUPOLE MOMENTS OF THE ISOMERIC Hg^{197*} NUCLEUS; ISOMERIC ISOTOPE SHIFT. A.C.Melissinos and S.P.Davis.
Phys. Rev., Vol. 115, No. 1, 130-7 (July 1, 1959).

The hyperfine structures of five optical lines of 65 hr radioactive Hg^{197} and 25 hr isomeric Hg^{197*} were measured. Radioactiv mercury produced by cyclotron bombardment and excited in electrodeless discharge tubes containing as few as 5×10^{12} atoms, fre of natural mercury, gave adequate light intensities. The analysis the hyperfine structure confirmed the magnetic dipole moment and isotope shift of Hg^{197} in its ground state ($I = \frac{1}{2}$), and gave the follow values for Hg^{197*} (based on $I = 13/2$): $\mu_{197*} = -1.04 \pm 0.01$ nm; $Q_{197*} = (1.5 \pm 0.3) \times 10^{-24}$ cm^2; isotope shift displacement (from Hg^{198} in the 2537 A line) $= 70 \pm 7 \times 10^{-3}$ cm^{-1}. Thus an isomeric shift of atomic energy levels resulting from the excitation of the nucleus from its ground state $I = \frac{1}{2}$ to the isomeric state $I = 13/2$ i observed. In the 2537 A line of mercury this shift amounts to $-21 \pm 6 \times 10^{-3}$ cm^{-1}.

539.

12620. MEASUREMENT OF THE NUCLEAR QUADRUPOLE MOMENT OF THE RADIOACTIVE ISOTOPES Cs^{135} AND Cs^{137}. H.Bucka, H.Kopfermann and E.W.Otten.
Ann. Phys. (Leipzig), Folge 7, Vol. 4, No. 1-5, 39-49 (1959). In German.

Describes the results of a double-resonance study of high-frequency transitions in the hyperfine structure of the excited $7^2P_{3/2}$ terms of the Cs spectrum. The quadrupole moments found are:

$$Q(Cs^{135}) = (+0.049 \pm 0.002) \times 10^{-24} \text{ cm}^2$$
$$Q(Cs^{137}) = (+0.050 \pm 0.002) \times 10^{-24} \text{ cm}^2.$$

S.J.St-Lora

539.14 : 539.

QUADRUPOLE MOMENT OF Sc^{45} NUCLEUS. See Abstr. 115

539.

12621. ON THE SHAPE OF α-ACTIVE NUCLEI.
L.L.Gol'din, G.I.Novikova and K.A.Ter-Martirosyan.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 512-16 (1959). In Russian.

The rate of α-decay to the successive levels of the main rotational band of the daughter nucleus permits one to determine shape of heavy nuclei. The quantities α_2 and α_4 which are the coefficients in the expansion of the nuclear shape in terms of Legen polynomials are computed. The calculations are performed for f even and three odd nuclei. The results of the calculations satisfa torily agree with each other and indicate that the contribution of t term $\alpha_4 P_4(\cos\theta)$ to the nuclear shape is significant.

539.14 : 539.

12622. THE PECULIARITY OF FORBIDDEN β-TRANSITIONS IN DEFORMED NUCLEI. Z.Bokhnatski.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 2, 158-61 (1958). In Russian. English summary: PB141041T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washingto D.C., U.S.A.

K-forbidden β^--decay matrix elements are calculated for nuc with odd A and even Z. A comparison is made of the results wit the experimental log ft values for the decay of Er^{171} to the forbidd levels of Tu^{171} and agreement is obtained.

E.J.Squir

539

12623. E1 TRANSITION AND NUCLEAR DEFORMATION IN TH EXCITED STATES. I.Dutt and P.Mukherjee.
Progr. theor. Phys., Vol. 21, No. 6, 792-8 (June, 1959).

The equilibrium deformation of some heavy nuclei in the exc states is calculated in the individual particle model of Nilsson. It found that the deformation remains practically unaltered. The electric dipole transition probabilities are also calculated using Nilsson's eigenfunctions, and it is found that in most of the cases the retardation is maximum when the deformation of the excited state coincides with that of the ground state.

539.14

1 24. ROTATIONAL STATES OF EVEN–EVEN NUCLEI.
C .DeMille, T.M.Kavanagh, R.B.Moore, R.S.Weaver and W.White.
Cad. J. Phys., Vol. 37, No. 9, 1036-43 (Sept., 1959).
Rotational energy levels of axially asymmetric nuclei were c culated in the manner of Davydov and Filippov and a comparison w h experiment shows good quantitative agreement. It is suggested th agreement may be improved by introducing the Bohr–Mottelson v ration–rotation interaction and a centrifugal stretching analogous t the type used in molecular spectra. The D–F method seems to be p ticularly useful for nuclei in the transition regions between "rota- tional" and "near-harmonic" modes of collective excitation.

539.14

1 25. ON THE PECULIARITIES OF NUCLEI WITH SMALL I FORMATION PARAMETERS. THE PROPERTIES OF Os^{190}.
I .Peker.
. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 2, 228-31 (1958).
Russian. English summary: PB 141041T-2, obtainable from Cice of Technical Services, U.S. Dept. of Commerce, Washington, D ., U.S.A.
The γ-rays observed accompanying the β-decay of Re^{190} and Ir^{190} h e been fitted into a decay scheme for Os^{190}. It is suggested that f this nucleus there is evidence that K practically ceases to be a g d quantum number and that it is not possible to separate satis- f torily the rotational motion from the internal motion.
L.L.Green

539.14 : 539.17

1626. STRENGTHS OF HIGH-ENERGY CAPTURE GAMMA RAYS I W^{184}.
J.Hughes, M.K.Brussel, J.D.Fox and R.L.Zimmerman.
lys. Rev. Letters, Vol. 2, No. 12, 505-6 (June 15, 1959).
Information about the spins, J, of the energy levels in heavy n lides can be obtained from a study of capture gamma-rays e itted from individual levels of nuclides bombarded with slow n trons. In the present work the method is applied to the com- p nd nucleus W^{184} where the electric dipole ground-state transition (7.42 MeV is allowed for the J = 1 levels but forbidden for the 0 levels. Definite ground-state gamma-rays have been detected f five of the six known levels up to 100 eV, thus establishing these t have J = 1. Relative transition probabilities for the various levels e given.
J.D.Dowell

539.14

627. A STUDY OF THE ENERGY LEVELS OF A^{37}, Sc^{48} AND V^{51}. A.T.G.Ferguson and E.B.Paul.
clear Phys., Vol. 12, No. 4, 426-31 (Aug. (1), 1959).
Thresholds for neutron emission resulting from proton bom- rdment of Cl^{37}, Ca^{48} and V^{51} have been observed. Four excited tes in A^{37}, nine excited states in Sc^{48} and nine excited states in V^{51} were established and the corresponding Q values determined about ± 10 keV. The threshold detector used is briefly described.

539.14

2628. ENERGY LEVELS IN Na^{23} FROM THE $Ne^{22}(p,\gamma)Na^{23}$ EACTION. J.J.Singh, V.W.Davis and R.W.Krone.
ys. Rev., Vol. 115, No. 1, 170-3 (July 1, 1959).
The gamma-ray excitation function for the $Ne^{22}(p,\gamma)$ reaction as investigated in the energy range 600 to 18 0 keV. Eleven sonances could definitely be identified to result from this reaction. e cascades leading to the ground state of Na^{23} were determined d found to proceed for the most part through well-known lower ing states, although no gamma-rays corresponding to transitions rough the 2.08 and 2.39 MeV were observed at any of the reson- ces investigated.

539.14 : 539.166

Gd^{155} LEVEL SCHEME. See Abstr. 11460

539.14

2629. LOWER EXCITED STATES OF Th^{231}.
.I.Filimonov and B.V.Pshenichnikov.
. eksper. teor. Fiz., Vol. 35, No. 2(8), 548-9 (Aug., 1958).
Russian. English translation in: Soviet Physics–JETP (New ork), Vol. 35(8), No. 2, 378-80 (Feb., 1959).
Investigation of γ-spectrum of Th^{231} produced in the α-decay of ^{235} using a scintillation spectrometer. The gamma quanta were ounted in coincidence with α-particles from U^{235}. From the spec- trum obtained a decay scheme is proposed for the lower levels of Th^{231}.
C.J.Batty

539.14

12630. THE SPIN ASSIGNMENTS OF THE 9.16 MeV AND 6.44 MeV STATES IN N^{14}. H.J.Rose, W.Trost and F.Riess.
Nuclear Phys., Vol. 12, No. 5, 510-20 (Aug. (2), 1959).
A study has been made of the gamma-ray cascade emitted by the 9.16 MeV state to the 6.44 MeV state and from this to the ground state of N^{14}, using the reaction $C^{13}(p,\gamma)N^{14}$ at the 1.75 MeV resonance. By means of angular correlation and distribution measurements, using different geometrical arrangements relative to the beam, the 9.16 MeV state was assigned J = 2 and the 6.44 MeV state, J = 3.

539.14 : 539.17

12631. COULOMB EXCITATION OF HIGH ENERGY NUCLEAR LEVELS IN EVEN ISOTOPES OF TUNGSTEN.
D.G.Alkhazov, A.P.Grinberg, G.M.Gusinskii, K.I.Erokhina and I.Kh.Lemberg.
Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1325-34 (1958). In Russian.
Natural tungsten and samples of tungsten enriched with isotopes of W^{182}, W^{184} and W^{186} were irradiated with 8.3 to 14.5 MeV α-particles. The existence of the following excited states has been established: W^{182}, 1.22 MeV; W^{184}, 0.90 MeV; W^{186}, 0.73 MeV. The reduced transition probabilities to the ground state B(E2) calculated for each of these levels were found to be respectively 0.051, 0.038, 0.040 (in units of $e^2 \times 10^{-48}$ cm^4). The supposition that these levels are of the vibrational type is discussed.

539.14

12632. RELATIVISTIC CORRECTIONS TO THE PHENOMENOLOGICAL THEORY OF LEVELS OF LIGHT NUCLEI.
F.A.Zhivopistsev, A.M.Perelomov and Yu.M.Shirokov.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 478-80 (1959). In Russian.
Relativistic corrections to the (phenomenologically prescribed) interaction between a pair of nucleons in a nucleus is computed on the basis of the expression obtained by Shirokopv for relativistic corrections to the nonrelativistic two-body Hamiltonian. It is found that the relativistic corrections strongly depend on the shape of the potential and are of the order of 0.02-0.2 MeV for a pair of nucleons.

539.14

12633. THE LIFETIME OF THE 1.416 MeV LEVEL OF RADIUM C'.
M.Tutter.
Z. Phys., Vol. 155, No. 3, 368-79 (1959). In German.
By the method of delayed coincidences the mean lifetime of the excited 1.416 MeV level of RaC' is measured to be $(2.3 \pm 1.9) \times \times 10^{-10}$ secs.
S.J.St-Lorant

539.14

12634. DETERMINATION OF THE PERCENTAGE OF ISOMERIC TRANSITION BY AN ABSORPTION METHOD.
P.C.Capron and A.Vander Stricht.
Bull. Acad. Roy. Belgique Cl. Sci., Vol. 64, No. 11, 1008-14 (1958). In French.
An expression is given for the activity following the capture of neutrons by a nucleus to form two isomeric states. It is shown that by using absorbers to vary the relative efficiencies for counting the activities due to the two states, values can be deduced for the ratio of the cross-sections for their formation and for the percentage of isomeric transition.
A.Ashmore

539.14

12635. ISOMERIC STATE OF PLATINUM-199.
M.A.Wahlgren and W.W.Meinke.
Phys. Rev., Vol. 115, No. 1, 191-3 (July 1, 1959).
An isomeric state of Pt^{199} was produced by thermal-neutron irradiation of normal and enriched platinum samples. The isomer decays with a half-life of 14.1 ± 0.3 sec by the emission of γ-rays of 32 ± 2 and 393 ± 2 keV energy. The thermal-neutron activation cross-section of Pt^{198} for the formation of the isomer is 0.028 ± ± 0.003 barn. Tentative level assignments are made, consistent with systematics and shell theory.

539.14

12636. OBSERVATION OF A BERYLLIUM HYPERFRAGMENT.
S.Matsumoto.
J. Phys. Soc. Japan, Vol. 13, No. 4, 427-8 (April, 1958).

The hyperfragment, $_{\Lambda}Be^{8}$ or $_{\Lambda}Be^{9}$, decayed at rest in a four-prong star. One product was a proton, and one probably a triton. Assuming only one neutron, three possible decay schemes are presented. The most probable scheme gives a binding energy for the Λ^0 particle of 7.2 ± 2.0 MeV. No decay product was as heavy as an alpha particle. D.W.L.Sprung

539.14

12637. AN ANALYSIS OF HYPERFRAGMENTS ORIGINATED IN K^--STARS. S.Mora and I.Ortalli.
Nuovo Cimento, Vol. 12, No. 6, 635-9 (June 16, 1959).

Data are given on 17 out of 27 observed mesonic hyperfragments from 4346 K^--stars found in emulsion exposed at the Bevatron K^--beam. Ranges and angles of the observed tracks are quoted. Definite decay schemes were established in nine cases. For the remaining events the possible decay schemes are given. Q values and Λ binding energies are listed. Attention is drawn to the two two-body decay events in which the binding energy of the Λ particle appears to be negative. E.G.Michaelis

RADIOACTIVITY

539.16 : 523.7

ASTRONOMICAL TESTS OF THE EXISTENCE OF Li^4.
See Abstr.11737

539.16 : 537.324

SNAP-III — ELECTRICITY FROM RADIONUCLIDES AND THERMOELECTRIC CONVERSION. See Abstr. 12316

539.163

12638. A NEW ISOTOPE OF GADOLINIUM, VERY DEFICIENT OF NEUTRONS. J.Olkowsky, M.le Pape, I.Gratot and L.Cohen.
Nuclear Phys., Vol. 12, No. 5, 527-31 (Aug. (2), 1959). In French.

Obtained from (α, xn) reactions on Sm^{144}. The half-life was measured to be 24 ± 1 min. It decays by electron capture and β^+-emission. The branching ratio β^+/X_K is 35%. Beta-energy, determined by absorption method, indicates that E_{max} = 2.5 MeV. This isotope shows a 780 keV γ-ray. Its mass is 144 or 145. Eu^{144} does not present the 18 min half-life given in previously published tables.

539.163

12639. NUCLEAR SPECTROSCOPIC STUDIES OF NEUTRON-DEFICIENT ISOTOPES IN THE RARE EARTH REGION.
K.S.Toth and J.O.Rasmussen.
Phys. Rev., Vol. 115, No. 1, 150-7 (July 1, 1959).

The conversion-electron spectra of four neutron-deficient rare earth isotopes are presented and discussed. The four isotopes are Tb^{153}, Tb^{154}, Dy^{155}, and Ho^{160}. Mihelich, Harmatz and Handley (Abstr. 597 of 1959) have presented the conversion electron data of a large number of rare earth isotopes, including all but one (Dy^{155}) of the four above-mentioned activities. The agreement between the two works is good. Some additional conversion lines, not reported by Mihelich et al., have been identified in this work as belonging to the decay of Tb^{153}, Tb^{154}, and Ho^{160}. Decay schemes are proposed for Dy^{155} and Tb^{155}. Tb^{154} and Ho^{160} decay to levels in Gd^{154} and Dy^{160}, respectively. The electron-capture decay data of Tb^{154} and Ho^{160} are compared with data obtained by other workers in the negatron decay of Eu^{154} and Tb^{160} to levels in Gd^{154} and Dy^{160}, respectively, and transitions common to both modes of decay are noted.

539.163

12640. NEW TERBIUM ISOTOPE, Tb^{152}.
K.S.Toth, K.T.Faler and J.O.Rasmussen.
Phys. Rev., Vol. 115, No. 1, 158-9 (July 1, 1959).

A careful examination of photon and electron spectra from cyclotron-produced mixtures of light terbium isotopes has led to the identification of a new isotope, Tb^{152}, with an 18.5 hr half-life. The 344.1 keV transition from first excited state to ground in daughter Gd^{152} has been identified and shown to be identical in energy to a transition associated with the beta decay of 9.3 hr Eu^{152m} to the same daughter nucleus. Gamma transitions of 180 and 265 keV are also assigned to the decay of Tb^{152}.

539.1

12641. DECAY OF FISSION PRODUCTS FROM U^{233}, U^{235} AND Pu^{239} FISSION.
J.Malý, J.Kutzendörfer, V.Macháček, V.Kouřím and V.Jeřábek.
Czech. J. Phys., Vol. 7, No. 1, 45-56 (1957). In Russian, with summary ($\frac{3}{4}$ pp) in English.

539.16

12642. DECAY OF Pm^{148}.
S.K.Bhattacherjee, B.Sahai and C.V.K.Baba.
Nuclear Phys., Vol. 12, No. 4, 356-70 (Aug. (1), 1959).

The radiations arising from the activities of Pm^{148} produced by proton bombardment of Nd^{148} (93% enriched) have been studied mainly by a coincidence scintillation spectrometer. Three gamma rays of 560, 900 and 1460 keV are associated with the 4.2 day activity, while the gamma-rays associated with the decay of the 46 day activity are 105, 195, 295, 400, 560, 630, 720, 930, 1015 and 1200 keV, of which 560 and 630 are the most intense and of equal intensity. Beta–gamma and gamma–gamma coincidence experiments show that the main levels in Sm^{148} arising from the negatron decay of the 46 day Pm^{148} are 560, 1190, 1590, 1910, 2120 and 2205 keV, the highest energy beta-group associated with this activity is 2330 keV which goes to the ground state of Sm^{148}. A tentative decay scheme is proposed for the 46 day Pm^{148} activity.

539.1

12643. DECAY OF K^{43}.
N.Benczer-Koller, A.Schwarzschild and C.S.Wu.
Phys. Rev., Vol. 115, No. 1, 108-14 (July 1, 1959).

The decay of K^{43} has been reinvestigated in an attempt to clarify the discrepancies existing in the ordering of the energy levels of Ca^{43}. The external conversion spectrum showed lines corresponding to the following gamma-ray energies: 0.220 ± 0.002, 0.371 ± 0.002, 0.388 ± 0.002, 0.394 ± 0.002, 0.591 ± 0.003, 0.614 ± 0.004 MeV. In addition a γ-ray of 1.005 MeV was observed in the scintillation spectrum. β–γ coincidence measurements establish that the gamma transitions to the ground state are the 0.371 MeV and the 0.591 MeV gamma-rays and not the 0.614 MeV gamma as believed previously. These results and the γ–γ coincidence measurements indicate only one possible level scheme in Ca^{43}: 0, 0.371, 0.591, 0.985, 1.373 MeV. These energy levels as well as their proposed spin and parity assignments are in good agreement with the results from the Massachusetts Institute of Technology nuclear reaction data. A two-cycle baffle for the solenoid β-spectrometer is described. This baffle reduces significantly the background due to scattered gamma radiation from very strong external conversion sources.

539.1

12644. DECAY OF $_{64}Gd^{161}$(3.73 MIN).
L.C.Schmid, S.B.Burson and J.M.Cork.
Phys. Rev., Vol. 115, No. 1, 174-7 (July 1, 1959).

The decay of Gd^{161}(3.73 min) is characterized by beta emission to excited states in Tb^{161}. This activity was investigated by means of the Argonne 256-channel scintillation coincidence spectrometer and photographic internal-conversion-electron spectrographs. Sources were prepared by neutron irradiation of Gd, enriched in Gd^{160}, in the Argonne reactor, CP-5. The presence of three beta-ray branches is deduced; two of these were observed experimentally by means of absorption methods. Fourteen gamma rays are reported. These radiations are fitted into a decay scheme which indicates excited states in Tb^{161} at 56.6, 134.0, 315.3, 417.6, 480.6, and 586.1 keV. A rotational band, based on the ground state and including the first two excited states, is indicated. Spin and parity assignments are also suggested for the third and fourth excited states.

539.1

12645. DECAY OF $_{60}Nd^{151}$(12 MIN). L.C.Schmid and S.B.Burson
Phys. Rev., Vol. 115, No. 1, 178-81 (July 1, 1959).

The decay of Nd^{151}(12 min) is characterized by beta emission to excited states in Pm^{151}. This activity was investigated by means of the Argonne 256-channel scintillation coincidence spectrometer and photographic internal-conversion-electron spectrographs. Sources were prepared by neutron irradiation of neodymium oxide, enriched in Nd^{150}, in the Argonne reactor CP-5. The presence of six beta-ray branches is deduced; four of these were observed experimentally by means of absorption methods. Thirty gamma transitions are reported. Twenty-seven of these and the six-beta-ray groups are fitted into a decay scheme which indicates the presence of excited

ates in Pm^{151} at 0.1172, 0.2560, 0.4265, 0.5336, 0.852, 0.937, 1.12, .29, 1.63, 1.87, and 2.17 MeV. The total energy difference between ie Nd^{151} parent and the Pm^{151} ground state is found to be ..4 ± 0.1) MeV. The low-lying levels in Pm^{151} are discussed with irticular reference to the possible existence of a rotational series ised on the ground state.

539.163

2646. DECAY OF SHORT-LIVED BARIUM AND LANTHANUM ISSION PRODUCTS. R.P.Schuman, E.H.Turk and R.L.Heath. hys. Rev., Vol. 115, No. 1, 185-7 (July 1, 1959).

The half-lives and gamma-ray spectra of the short-lived barium id lanthanum fission products were measured. Ba^{141} has a half-fe of 18 ± 1 min and emits X-rays and gamma-rays of 120, 190, 30,~ 350, 460, 640, and 740 keV. Ba^{142} has a half-life of 11 ± 1 min id emits X-rays and gamma rays of 80, ~ 260, 890, 970, 1080, 1200, 360, and 1680 keV. La^{141} has a half-life of 3.85 ± 0.10 hr and emits low-intensity gamma-ray at 1370 keV. La^{142} has a half-life of 5 ± 6 min and emits gamma-rays of 640, 900, 1030, 1080, 1370, 540, 1750, 1920, 2080, 2400, 2570, 3000, 3300, and 3650 keV.

539.163

2647. DECAY OF $_{50}Sn^{113}$ (112 DAYS) AND $_{49}In^{113m}$ (1.73 HR). .B.Burson, H.A.Grench and L.C.Schmid. hys. Rev., Vol. 115, No. 1, 188-91 (July 1, 1959).

Samples of Sn^{113} (112 days) were produced by neutron irradiation f tin enriched in Sn^{112}. The gamma-rays were studied by scintil-ation methods using the Argonne 256-channel analyser; the nternal-conversion electrons were investigated by means of a 80° β-ray spectrometer. In addition to the well-established 393-keV amma-ray, a gamma-ray of 255 keV was found. Studies of all the in radioisotopes showed the latter to be in the Sn^{113} activity. Energy levels in In^{113} at 393 and 648 keV, the latter having spin or $\frac{5}{2}$, are indicated.

539.163 : 539.14

2648. LEVELS IN Gd^{156} EXCITED IN THE DECAY OF 5.6 d Tb^{156}. .G.Hansen, O.B.Nielsen and R.K.Sheline. Nuclear Phys., Vol. 12, No. 4, 389-412 (Aug. (1), 1959).

The decay of 5.6 day Tb^{156} has been studied by means of a six ap β-ray spectrometer, scintillation spectrometers, and coincidence echniques. Conversion electron and γ-ray coincidence measurements ave been used extensively for obtaining quantitative estimates of -ray intensities. A description of the electronic equipment is iven, including a scaler and gate unit, which improves the perform-nce of a relatively slow (τ = 700 μsec) multichannel analyser. Twenty-four transitions are assigned to Tb^{156}. Multipole orders are iven in most cases. The following levels are proposed and their uantum numbers (K, I, π) given in parenthesis: 89 keV (0, 2^+), 99 keV (0, 4^+), 584 keV (0, 6^+), 1126 keV (tentative), 1152 keV (2, 2^+), 246 keV (2, $?^+$), 1507 keV (4, 4^+), 1620 keV (4, 5^+), 1931 keV (3^-), nd 2042 keV (4^-). Violation of K-selection rules and significant eviations from the expected branching ratios for transitions to a otational band are observed. These features are discussed in terms f a probable mixing of the rotational bands.

539.163

2649. HALF-LIVES OF TWO EXCITED STATES OF Gd^{156}. R.E.Bell and M.H.Jørgensen. Nuclear Phys., Vol. 12, No. 4, 413-17 (Aug. (1), 1959).

The half-lives of the 1507 and 89 keV excited states were measured with a fast time-to-amplitude converter. The half-life of the 1507 keV 4+ state is (1.88 ± 0.10) × 10^{-10} sec, in agreement with estimates made in the preceding abstract. This result throws serious doubt on the supposed measurement of the half-life of the 288 keV state by Ofer. The half-life of the 89 keV first rotational state is (2.19 ± 0.07) × 10^{-9} sec, differing slightly from a previous measurement by Nathan (Abstr. 5281 of 1958). The new value leads o a reduced transition probability for the reverse (Coulomb excitation) process B(E2): e^2= (4.64 ± 0.20) × 10^{-48} cm^4, in excellent agreement with the value directly measured by Coulomb excitation by Ramsak et al (Abstr. 5356 of 1958).

539.164

12650. LIFETIME OF THE 241 keV STATE OF Tn^{220}. J.G.Siekman and G.T.Pott. Physica, Vol. 24, No. 11, 910-12 (Nov., 1958).

The decay of ThX leads in 4.8% of cases to an excited state at 241 keV.

$$\begin{aligned} ThX &\rightarrow \alpha + ThX^* \\ ThX^* &\rightarrow ThX + \gamma\ (241\ keV) \\ K\ conversion &\searrow ThX + e^-\ (141\ keV) \end{aligned}$$

By detecting the α-particles in coincidence with the K-conversion electrons the lifetime of this excited state has been determined as (4.5 ± 1.6) × 10^{-10} sec. A.E.I. Research Laboratory

539.164

12651. ENERGY SPECTRA OF α-PARTICLES EMITTED FROM THE LONG LIVED ISOTOPES Th^{232} AND U^{238}. G.E.Kocharov, A.P.Komar and G.A.Korolev. Zh. eksper. teor. Fiz., Vol. 36, No. 1, 68-75 (1959). In Russian.

The α-spectra of Th^{232} and U^{238} were investigated by means of an ionization chamber with a grid. The energies and intensities of the transitions to the 2^+ and 4^+ levels of the daughter nuclei were determined.

539.165

12652. A METHOD FOR ESTIMATING BETA-COUNTING EFFICIENCIES. B.P.Bayhurst and R.J.Prestwood. Nucleonics, Vol. 17, No. 3, 82-5 (March, 1959).

A relationship between counting efficiencies and average energy of β-particles for about 20 β-emitters was measured for a standard β-counting system. It is shown that using this method efficiencies for other nuclides can be estimated to better than 3%. R.D.Smith

539.165

12653. ANGULAR DISTRIBUTION OF POLARIZED ELECTRONS EMITTED FROM ORIENTED NUCLEI. H.Mahmoud. Ann. Phys. (New York), Vol. 7, No. 4, 429-39 (Aug., 1959).

A procedure first used by Rose and Osborn (Abstr. 6856 of 1954) is applied. The final result is an exact expression in which the only unknown quantities are the reduced matrix elements. The latter can be evaluated only after a definite nuclear model is adopted.

539.165

12654. THE USE OF FORRO'S METHOD TO DETERMINE THE END POINT ENERGY OF A β-RAY SPECTRUM. C.Mahaux, G.Guében and L.Winand. Bull. Soc. Roy. Sci. Liege, Vol. 28, No. 3-4, 57-68 (March-April, 1959). In French.

Measurements made on the absorption of β-particles in gold for a large number of isotopes show that a simple relationship exists between E_{max} (max. β-particle energy) and the mass absorption coefficient. Between the limits 0.25 MeV ≤ E ≤ 2.5 MeV the authors show that the equation $E_{max} = 10.24\left(\frac{\mu}{\rho}\right)^{-0.733}$ is accurate to better than 4% and is only slightly dependent upon apparatus-geometry. A determination of the mass absorption coefficient for an unknown β-emitter may therefore be used to identify it rapidly and accurately. In the case of complex β-spectra absorption methods are shown to be capable of analysing the different components. A.E.I. Research Laboratory

539.165

12655. A SPHERICAL WAVE EXPANSION FOR DOUBLE β-DECAY. S.P.Rosen. Canad. J. Phys., Vol. 37, No. 6, 780-5 (June, 1959).

Spherical wave solutions of the Dirac equation for a central field and the properties of angular momentum coupling coefficients are used in a general formulation of the theory of neutrino-less double β-decay transitions of arbitrary forbiddenness. J.C.Taylor

539.165 : 530.145

EQUIVALENCE TRANSFORMATION OF THE β-DECAY OPERATOR. See Abstr. 11847

539.165

12656. THE CONVERSION ELECTRON SPECTRUM OF THE DYSPROSIUM FRACTION. B.S.Dzhelepov, B.K.Preobrazhenskii, I.M.Rogachev and P.A.Tishkin. Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 2, 126-34 (1958). In Russian. English summary: PB 141041T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The conversion spectrum of the dyprosium fraction, chemically and chromatographically separated from the Ta target after fast

proton irradiation, was studied using two magnetic-lens β-spectrometers. Lines, the intensity of which decreased with half-lives of 7.5-11 hr, 38 hr and 4.7 days, were observed. The transitions of 15 lines in the range 3-150 keV corresponding to the 7.5-11 hr half-life were identified and attributed to Dy^{156} and Dy^{157}. It was not possible to ascribe to any particular isotope the lines associated with the 38 hr half-life. It is suggested that some conversion lines corresponding to the 4.7 day half-life might belong to Tb^{157} accumulating from Dy^{157}. A decay scheme for Tb^{157} is discussed in the light of these results. I.C.Demetsopoullos

539.165

12657. POSITRON SPECTRA OF THE DYSPROSIUM FRACTION. B.S.Dzhelepov, O.E.Kraft, B.K.Preobrazhenskii and G.F.Yushkevich. Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 2, 208-10 (1958). In Russian. English summary: PB 141041T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D C., U.S.A.

The spectrum of the dysprosium fraction, obtained by separation from the Ta target after irradiation by 660 MeV protons, was investigated using a β-spectrometer in order to determine the isotopes present. In addition to the positron activity, eleven conversion electron peaks were observed, six possessing a half-life of 11 ± 2 hours. It is assumed that these are K-electrons, the transitions probably corresponding to Dy^{155} or Dy^{157}. The ratio of the number of positrons to the number of 515 keV conversion electron transitions was found to be 37.5. A half-life of 4.7 days associated with four groups of conversion electrons is attributed to the decay of Tb^{155}. The origin of the observed 20 hr half-life is not clear, but it is suggested that the respective positron spectrum refers to the 18 hr half-life Tb isotope. I.C.Demetsopoullos

539.165

12658. INTERNAL BREMSSTRAHLUNG FROM P^{32}. B.Persson and S.A.E.Johansson. Nuclear Phys., Vol. 12, No. 4, 432-45 (Aug. (1), 1959).

The spectrum of internal bremsstrahlung from P^{32} has been measured in a coincidence experiment. The β-particles are detected by an anthracene scintillation spectrometer and the bremsstrahlung spectrum measured by a sodium iodide scintillation spectrometer. Pulses in a certain energy range are selected in the anthracene spectrometer by a single channel analyser. They are used to gate the 100 channel analyser which records the bremsstrahlung spectrum. The angle of emission between the β-particles and the bremsstrahlung is defined by the orientation of the spectrometers. The experiment has been performed for a number of different angles. The experimental results are compared with the theory of Knipp and Uhlenbeck and with that of Bloch. The agreement is very good.

539.165

12659. BETA DECAY OF Bk^{250} AND Bk^{249}. S.E.Vandenbosch, H.Diamond, R.K.Sjoblom and P.R.Fields. Phys. Rev., Vol. 115, No. 1, 115-21 (July 1, 1959).

The beta decay of Bk^{250} was studied with a beta spectrometer. Bk^{250} has two beta groups: 725 ± 15 keV (89 ± 1% abundant) and 1760 ± 50 keV (11 ± 1% abundant). Conversion electron lines corresponding to 42.2, 98.2, 890, 930, 990 and 1032 keV transitions were observed and their intensities measured. The information obtained from crystal spectrometer singles and coincidence measurements was combined with beta spectrometer data to construct a decay scheme for Bk^{250} involving gamma vibrational levels in Cf^{250} analogous to those found in Pu^{238}. The beta half-life of Bk^{250} is 193.3 ± 0.3 minutes. The electron capture partial half-life of Bk^{250} is estimated to be greater than 50 hr. The beta spectrum of Bk^{249} shows an allowed or first-forbidden transition with an end-point energy of 125 ± 2 keV.

539.165

12660. LONGITUDINAL POLARIZATION OF β PARTICLES IN THE DECAY OF Pr^{144}. D.Tadić. Period. math.-phys. astron. (Zagreb), Vol. 13, No. 4, 267-72 (1958).

A calculation of the longitudinal polarization of the electrons in first-forbidden $0^- \rightarrow 0^+$ transitions, using the results of Alder, Stech and Winther (Abstr. 8802 of 1957) and of Alaga and Jakšić (Abstr. 11443 of 1959). J.C.Taylor

539.165

12661. ON THE ELECTRON CAPTURE TO POSITRON EMISSION RATIOS IN THE DECAYS OF ^{56}Co AND ^{84}Rb. J.Konijn, H.L.Hagedoorn, H.van Krugten and J.Slobben. Physica, Vol. 24, No. 11, 931-4 (Nov., 1958).

Coincidences were observed between positrons from the decay of Co^{56} and γ-rays from de-excitation of the resulting Cr^{56}, leading to an electron capture to positron emission ratio, ϵ/β^+, of 5.67 ± 0 for the transition to the 805 keV level, in good agreement with the theoretical value of 5.56 ± 0.26. End points of positrons from the decay of Rb^{84} to Kr^{84} were measured with a long lens β-spectrometer as 1667 ± 11 keV (44%) and 802 ± 25 keV (56%). The ϵ/β^+ ratios, derived from β–γ coincidence measurements, were 5.72 ± 0.12 for the transition to the 880 keV level, and 1.25 ± 0.28 for the ground state transition, the latter being in agreement with the theoretical value of 1.01 ± 0.03 for a unique first forbidden transition. A.E.I. Research Laboratory

539.165

12662. β–γ-CORRELATION IN FIRST FORBIDDEN β-TRANSITIONS. Yu.V.Gaponov. Zh. eksper. teor. Fiz., Vol. 36, No. 1, 193-203 (1959). In Russian.

A general formula has been obtained for the β–γ-correlation of β-decay electrons and circularly polarized γ-quanta emitted by the excited nucleus formed after β-decay. The formula is valid for first forbidden β-transitions. The calculation is performed for an arbitrary mixture of β-coupling, account being taken of the nuclear Coulomb field and in particular of the so-called "Coulomb" terms. Two particular cases are considered: (i) unique; (ii) Coulomb β-transitions.

539.165 : 539.1.07 : 621.3

β–γ ANGULAR CORRELATION OF Rb^{86}. See Abstr. 12529

539.165

12663. SPECTRUM OF THE INTERNAL CONVERSION ELECTRO ACCOMPANYING THE α-DECAY OF Pu^{238} AND Pu^{240}. E.F.Tret'yakov, L.N.Kondrat'ev, G.I.Khlebnikov and L.L.Gol'din. Zh. eksper. teor. Fiz., Vol. 36, No. 2, 362-6 (1959). In Russian.

The spectrum was studied with a large-aperture magnetic spectrometer with toroidal field shape, measuring α–e coincidence. Transitions from the 6+ excited levels were detected. The multipolarity and more precise energy values were determined for transitions from the 4+ and 2+ levels.

539.165

12664. DETERMINATION OF THE BETA-DECAY INTERACTION FROM ELECTRON–NEUTRINO ANGULAR CORRELATION EXPERIMENTS. J.S.Allen. Rev. mod. Phys., Vol. 31, No. 3, 791-6 (July, 1959).

An account is given of the measurements made at the University of Illinois on electron–neutrino angular correlation in β-decay. The most recent experiments on A^{35} and He^6 show that the interaction is predominantly V for Fermi transitions and A for Gamow–Teller transitions. The latter is also confirmed by measurements on Ne^{23} assuming the Fermi matrix element is small in the transition to the excited state of Ne^{23}. A scalar or tensor admixture of 10% or less is not excluded. A.Ashmore

539.16

12665. ON THE EXCITED LEVELS OF Pt^{192}. L.Keszthelyi and J.Zimányi. Acta phys. Hungar., Vol. 10, No. 1, 1-6 (1959).

The 784 keV energy level of Pt^{192} decays partly by 468 keV E2 radiation into the 316 keV excited level, partly by 784 keV E4 radiation into the ground state. It follows from the high intensity of the cross-over that the 468 keV transition has to slow down in about 10^{-8} sec. Coincidence measurements give the life-time of the 468 keV transition as $\tau < \approx 2 \times 10^{-8}$ sec. By scintillation spectrometer measurements of the high-energy part of the Pt^{192} spectrum, the relative intensity of the 784 keV radiation has been obtained as $< 0.5 \times 10^{-3}$ (in terms of the intensity of the 600 keV line). From the coincidence measurements it seems probable that the intensity of the 784 keV E4 transition is less by 3 orders of magnitude than the above value. The existence of the 1050 and 1210 keV lines has been verified by the present measurements.

539.16

12666. PRECISION MEASUREMENT OF THE ENERGY OF SOME LINES IN THE SPECTRA OF Ir^{192} AND $Eu^{150;154}$. V A.Romanov. Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 2, 191-3 (1958). In Russian. English summary: PB 141041T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The energy of the 296, 308 and 316 keV lines from the decay of Ir^{192} was found to be 295.87 ± 0.03, 308.35 ± 0.03 and 316.41 ± 0.03 keV by comparison of the position of these lines with the position of the 222.22 and 234.61 keV lines from RaTh. The energy resolution was 0.04% and the energy of the corresponding K-conversion lines was also determined. Similar measurements were performed using $Eu^{152,154}$ with a resolution of 0.07%. The energy of the 122 and 123 keV lines was found to be 121.75 ± 0.03 and 123.06 ± 0.03 keV.

C.J.Batty

539.166

12667. INVESTIGATION OF TIME CORRELATIONS OF THE GAMMA RADIATIONS FROM Sb^{124} AND Cs^{134}.
L.L.Pelekis and Z.É.Pelekis.
Latv. PSR Zinat. Akad. Vestis, No. 10(135), 109-20 (1958).
In Russian.

Describes a method for investigating gamma ray cascades using CsI(Tl) scintillation counters in coincidence; one of the crystals subtends nearly 4π solid angle at the source. The method is applied to the decay scheme of Sb^{124} and Cs^{134}.

J.W.G.Wignall

539.166

12668. GAMMA SPECTROMETRIC ASSAY OF FISSION-PRODUCT Kr^{85}. H.W.Alter.
Nucleonics, Vol. 17, No. 4, 124 (April, 1959).

A 3 in. NaI crystal was used to measure the 0.52 MeV γ-ray. Advantages over the more usual β-ray method include better discrimination against other nuclides including Xe^{133} and A^{39}.

R.D.Smith

539.166

12669. ANGULAR CORRELATION OF INTERNAL CONVERSION PAIRS DETECTED IN A NEUTRON AND GAMMA BACKGROUND. APPLICATION TO N^{14}, Be^{10}, B^{10}.
S.Gorodetzky, P.Chevallier, R.Armbruster and G.Sutter.
Nuclear Phys., Vol. 12, No. 4, 34–55 (Aug. (1), 1959). In French.

The determination of nuclear electromagnetic transitions by angular correlations of internal conversion pairs is extended to reactions induced by deuterons. The background is eliminated by the addition of thin crystals to the usual β scintillation spectrometer. This technique is applied to certain transitions in N^{14}, Be^{10} and B^{10}.

NUCLEAR REACTIONS

539.17

12670. FORMATION OF MERCURY ISOTOPES 197, 195 and 194, BY THE REACTION OF 155 MeV PROTONS ON GOLD.
N.Poffé, M.Riou and J.Teillac.
C.R. Acad. Sci. (Paris), Vol. 248, No. 25, 3552-4 (June 22, 1959).
In French.

The cross-sections for the (p,n) and (p,3n) reactions in gold were determined by measuring the activities of Hg^{197} and Au^{195}, yielding values of 31 and 25 mb (±30%) respectively. The measured cross-section for the formation of Hg^{194} (p,4n reaction) is found to be about 1 mb, which is in disagreement with a calculated value of 38 mb. This discrepancy is ascribed to the difficulties experienced in the interpretation of the disintegration of Hg^{194}. J.D.Dowell

539.17 : 539.12

DIFFRACTION PHENOMENA IN COLLISIONS OF FAST PARTICLES WITH NUCLEI: See Abstr. 12534

539.17

12671. ANTIPROTON–NUCLEUS AND ANTIPROTON–PROTON INTERACTIONS. M.Nozawa, T.Gotô, N.Yajima and R.Nakasima.
Progr. theor. Phys., Vol. 17, No. 3, 504-6 (March, 1957).

Data on the interaction of antiprotons with Cu and Be are discussed in terms of an optical model. R.J.N.Phillips

539.17

12672. INVESTIGATION OF THE $Be^9(p,n)B^9$ AND $Be^9(p,\alpha\gamma)Li^6$ REACTIONS. J.B.Marion and J.S.Levin.
Phys. Rev., Vol. 115, No. 1, 144 (July 1, 1959).

A pulsed-beam time-of-flight technique was used to study neutrons and γ-rays from the proton bombardment of Be^9 in the energy range from 2.3 to 5.4 MeV. Excitation curves for the ground-state neutron group from the $Be^9(p,n)B^9$ reaction were measured at 0° and 90°. These curves show the well-known resonances at 2.56 and 4.6 MeV and, in addition, show a broad maximum near 3.5 MeV. The γ-ray excitation curve also indicates maxima at 2.56, 3.5, and 4.5 MeV. The 3.5 and 4.6 MeV resonances are tentatively assigned to p- and d-wave states having ($J = 2^+$, $T = 1$) and ($J = 3^-$, $T = 1$), respectively. The previously observed maximum near 4.9 MeV appears to be the result of the effect of the 3.5 MeV resonance on the n_1 group immediately above its threshold. The cross-section for the production of continuum neutrons is appreciable for proton energies above about 3 MeV. A large fraction of these neutrons appear to result from the neutron decay of the 2.43 MeV Be^9 level following the inelastic excitation of this level.

539.17

12673. MULTI-CHARGED PARTICLES EMITTED IN DISINTEGRATION OF CARBON NUCLEI BY 660 MeV PROTONS.
V.I.Ostroumov and Yu.P.Yakovlev.
Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1358-63 (1958).
In Russian.

Multi-charged particles ejected from a thin polystyrene film bombarded with 660 MeV protons and possessing ranges larger than 20 μ were investigated by means of nuclear emulsions. The effective cross-section for production of these particles and their angular and energy distribution have been obtained. Measurements of the thicknesses of tracks produced by the fragments were employed to determine the charge of particles with ranges above 40 μ in the emulsion.

539.17

12674. POLARIZATION OF PROTONS ELASTICALLY SCATTERED ON Si^{28} NUCLEI. P.V.Sorokin, A.K.Val'ter, I.Ya.Malakhov and A.Ya.Taranov.
Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1386-90 (1958).
In Russian.

The degree of polarization of protons scattered through angles of 60°, 90°, 125° and 150° in the c.m.s. and energy interval of 1.6 to 2.2 MeV is determined on basis of a phase shift analysis of experimental data on the elastic scattering cross-section. Polarization at angles of 60° and 90° were measured, the He^4 nucleus being employed as the analyser. Within the limits of experimental error the calculations and experimental results are in agreement.

539.17

12675. NUMERICAL EVALUATION OF DEUTERON STRIPPING CROSS SECTIONS AND POLARIZATIONS. W.Tobocman.
Phys. Rev., Vol. 115, No. 1, 98-107 (July 1, 1959).

The distorted-wave Born approximation is applied to deuteron stripping reactions. Optical potentials with rounded edges are used to distort the wave-functions used in the calculations. It is found possible to get a fair fit to the (d,p) cross-section in four cases and to the (d,p) polarization in one case with this treatment without introducing a cutoff.

539.17

12676. USE OF ANTISYMMETRIZED WAVE FUNCTION FOR DEUTERON STRIPPING REACTION. K.Nakamura and M.Soga.
Progr. theor. Phys., Vol. 21, No. 6, 837-55 (June, 1959).

The general S-matrix of a nuclear reaction is derived by the method of second quantization in order to take account of antisymmetrization of the total system. A deuteron stripping reaction is treated as an example of the general theory. The amplitude obtained by this method is compared with that obtained by other theories. The amplitude of this reaction is discussed for a special target which seems to demonstrate the effect of antisymmetrization most clearly. In the case of $O^{17}(d,p)O^{18}$ the effect of antisymmetrization becomes comparable with the direct part.

539.17

12677. ANALYSIS OF DEUTERON STRIPPING EXPERIMENTS. R.D.Amado.
Phys. Rev. Letters, Vol. 2, No. 9, 399-401 (May 1, 1959).

It is pointed out that recent work by Chew and Low in a different context casts light on questions met with in Butler's theory.

W.A.Hepner

539.17

12678. ON THE ROLE OF EXCHANGE EFFECTS IN STRIPPING REACTIONS. V.G.Neudachin, I.B.Teplov and O.P.Shevchenko.
Zh. eksper. teor. Fiz., Vol. 36, No. 3, 850-3 (1959). In Russian.

A general expression is obtained for the cross-section for heavy-particle stripping as one of the exchange effects in stripping theory. Some results of numerical computations of exchange effects in stripping reactions are presented for some of the simplest cases.

539.17

12679. REMARKS ON THE ELASTIC SCATTERING OF DEUTERONS BY HEAVY NUCLEI. Y.Nishida.
Progr. theor. Phys., Vol. 17, No. 3, 506-8 (March, 1957).

Argues that deviations from Coulomb scattering at low energy may be due more to electric disintegration than to nuclear absorption. R.J.N.Phillips

539.17

12680. INVESTIGATION OF STRIPPING REACTIONS OF THE (d,p) TYPE IN SILICON ISOTOPES. V.G.Sukharevskii.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 52-9 (1959). In Russian.

The angular distributions of protons from the reactions $Si^{29,30}(d,p)Si^{30,31}$ were measured with nuclear emulsions for the ground and first excited states at deuteron energies of 4.3 MeV. The orbital angular momenta in the captured neutrons, the absolute values of the differential cross-sections of the reactions and the reduced neutron level widths in the final nuclei were determined. The experimental proton angular distributions are compared with the theoretical curves of Butler and Bhatia. The spins and parities of the ground and first excited states of Si^{31} confirm the calculations of Goldhammer.

539.17

12681. ON THE RATIO BETWEEN THE ISOMERIC AND GROUND STATE YIELDS OF Zn^{69} PRODUCED IN VARIOUS NUCLEAR REACTIONS.
K.I.Zherebtsova, T.P.Makarova, Yu.A.Nemilov and B.L.Funstein.
Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1355-7 (1958). In Russian.

The ratio between the amounts of Zn^{69} atoms produced in the isomeric and ground states in the $Zn^{68}(d,p)Zn^{69}$, $Ga^{69}(n,p)Zn^{69}$ and $Ga^{71}(d,\alpha)Zn^{69}$ reactions was studied. In the first reaction the relative yield of the isomeric state first increases with the deuteron energy and then remains constant (about 0.5 of the ground state yield). In the second reaction the ratio is 1.4 for a neutron energy of 14 MeV and in the third reaction about 0.5 for a deuteron energy of 6-8 MeV. The results obtained are discussed on the basis of various interaction mechanisms (direct interaction and compound nucleus formation).

539.17 : 539.12

ELASTIC SCATTERING OF DEUTERONS BY He^4: POLARIZATION. See Abstr. 12604

539.17

12682. ANALYSIS OF ANGULAR DISTRIBUTIONS IN THE REACTION $B^{11}(\alpha,p)C^{14}$. L.L.Lee, Jr. and J.P.Schiffer.
Phys. Rev., Vol. 115, No. 1, 160-5 (July 1, 1959).

Angular distributions of protons from the $B^{11}(\alpha,p)C^{14}$ reaction were measured with alpha-particle energies ranging from 2.0 to 3.7 MeV. Eight resonances in the reaction were observed, corresponding to states in N^{15} in the range from 12.50 to 13.60 MeV excitation. Analysis in terms of the compound nucleus formalism has yielded spin and parity assignments for the six most prominent resonances.

539.17

12683. EMISSION OF ALPHA PARTICLES FROM A COMPOUND SYSTEM OF HIGH ANGULAR MOMENTUM.
W.J.Knox, A.R.Quinton and C.E.Anderson.
Phys. Rev. Letters, Vol. 2, No. 9, 402-4 (May 1, 1959).

The energy spectra of α-particles produced by irradiating Ni targets with 162 MeV oxygen ions were measured at various angles. The relative differential cross-section variation with angle indicates that the process is predominately one of nuclear evaporation, although there is some forward peaking, indicating that a direct interaction mechanism is also involved.

A.E.I. Research Laboratory

539.17

12684. SOME RESULTS ON THE PHOTODISINTEGRATION OF SAMARIUM. G.Di Caporciacco, M.Mandò and F.Ferrero.
Nuovo Cimento, Vol. 13, No. 3, 522-31 (Aug. 1, 1959).

The total electron capture to β^+ emission of Sm^{143} was determined with respect to that of Pr^{140}; the experimental result is $\epsilon_{Sm} = \epsilon_{Pr} \times 1.289$. Taking this branching ratio into account the yield of the $Sm^{144}(\gamma,n)$ reaction is shown to be in agreement with the theoretically expected value. Evidence is given for a 74 min activit attributable to Sm^{143} from the $Sm^{144}(\gamma,2n)$ reaction; an indication for its K : β^+ ratio is also given.

539.17

12685. INTERMEDIATE-ENERGY PHOTODEUTERONS FROM C^{12} AND Be^9. V.P.Chizhov and L.A.Kul'chitskii.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 345-52 (1959). In Russian.

The energy distribution of deuterons and protons and the energy dependences of the ratios of the deuteron to proton yields are presented for the case of photodisintegration of C^{12} and Be^9. In the case of C^{12} the disintegration was induced by bremsstrahlung of $E_{\gamma max}$ = 80 MeV from a synchrotron and $E_{\gamma max}$ = 90 MeV in the case of Be^9. A semi-empirical analysis of the results pertaining to deuterons is carried out under the assumption that the deuterons are formed in the so-called "pick-up" process. The analysis is also extended to the experimental results of other investigators.

539.1

12686. MEASUREMENT OF PHOTONUCLEAR ABSORPTION CROSS SECTIONS. J.Kockum and N.Starfelt.
Nuclear Instrum. and Methods, Vol. 5, No. 1, 37-43 (July, 1959).

The total photonuclear cross-sections for carbon, aluminium, sulphur, and iron have been measured in the energy region of the giant resonance. A total absorption scintillation spectrometer was used to study the transmission of the bremsstrahlung spectrum from a 30 MeV synchrotron through long absorbers. The integrated total photonuclear cross-section between 10 and 27 MeV, as well as the width of the giant resonance, was obtained. The measured widths are definitely larger for the deformed nuclei aluminium and iron than for the spherical carbon nucleus, whereas the width for sulphur has an intermediate value.

539.17 : 539.1

STRENGTHS OF HIGH-ENERGY CAPTURE GAMMA RAYS IN W^{184}. See Abstr. 12626

539.1

12687. ANGULAR DISTRIBUTIONS OF NEUTRONS INELASTICALLY SCATTERED FROM SODIUM.
E.N.Shipley, G.E.Owen and L.Madansky.
Phys. Rev., Vol. 115, No. 1, 122-6 (July 1, 1959).

The angular distribution and total cross-section for neutron inelastic scattering proceeding to the first excited state in sodium were measured by observing the neutron–gamma coincidences. Th measured total cross-sections for the various neutron energies use are σ_T(3.49 MeV) = 370 ± 120 mb, σ_T(3.75 MeV) = 270 ± 90 mb, and σ_T(4.00 MeV) = 280 ± 90 mb. The differential cross-sections were found to be higher in the backward than in the forward directions.

539.17 : 539.12

12688. ABSORPTION OF POLARIZED μ^--MESONS BY NUCLEI. ANGULAR DISTRIBUTION OF THE NEUTRONS.
E.I.Dolinskii and L.D.Blokhintsev.
Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1488-98 (1958).
In Russian.

The angular distribution of neutrons produced in the absorption of polarized μ^--mesons by nuclei is calculated. Numerical calculations are performed for O^{16} and Ca^{40}.

539.17 : 539.1

THEORETICAL CALCULATIONS ON $\mu^- + C^{12} \rightarrow B^{12} + \nu$. See Abstr. 12569

539.17

NUCLEAR REACTIONS DUE TO COSMIC RAYS. See also the Section entitled "COSMIC RAYS".

539.17 : 539.12

12689. ABSORPTION OF POLARIZED μ^--MESONS BY NUCLEI. NEUTRON POLARIZATION. L.D.Blokhintsev.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 258-63 (1959). In Russian.

Formulae are derived for the polarization of neutrons produced as a result of absorption of polarized μ^--mesons by nuclei. Estimations for the O^{16} and Ca^{40} nuclei are presented.

539.17

2690. FISSION OF Th^{232} BY NEGATIVE μ- AND π-MESONS.
L.G.Petrashku and A.K.Mikhul.
okl. Akad. Nauk SSSR, Vol. 126, No. 4, 752-4 (June 1, 1959).
Russian.

Fission was studied by irradiating nuclear emulsions impregated with thorium nitrate. The data allow a determination of the atio of radiationless 2p-1s transitions for μ^--mesons to those ith radiation, which turns out to be 0.1 ± 0.07 and is substantially ss than in uranium. G.E.Brown

539.17 : 532.65

2691. DISRUPTION OF A CHARGED LIQUID DROP AND UCLEAR FISSION. B.T.Geilikman.
h. eksper. teor. Fiz., Vol. 36, No. 1, 249-52 (1959). In Russian.

Disruption of a charged liquid drop is considered. The vibraonal energies of the parts of the drop are computed and also the nergy of their relative motion. The general results thus obtained re applied to fission of nuclei.

539.17

2692. ON THE QUESTION OF THE MECHANISM OF EMISSION OF NSTANTANEOUS NEUTRONS IN FISSION. V.S.Stavinskii.
h. eksper. teor. Fiz., Vol. 36, No. 2, 629-30 (1959). In Russian.

Recent measurements [Bowman and Thompson, Second International Conference on the Peaceful Uses of Atomic Energy, Geneva 1958). A/Conf.15/P/652] indicate that instantaneous neutrons tend o be emitted anisotropically with respect to the main fission fragnents and with a sharply peaked energy spectrum in the region 0.1-.2 MeV. This cannot be accounted for on a simple evaporation icture, but suggests high deformations immediately prior to fission. f this picture is valid, detailed studies of the angular distributions f these neutrons could lead to information about the compressibility f nuclear matter, and changes in the mean free path for neutrons assing through compressed nuclear matter. G.P.McCauley

539.17

2693. PECULIARITIES OF Bi FISSION AT VERY HIGH EXCITATION ENERGIES. V.F.Darovskikh and N.A.Perfilov.
Zh. eksper. teor. Fiz., Vol. 36, No. 3, 652-7 (1959). In Russian.

Nuclear emulsions were used to study the relative yields for Bi ission induced by 660 MeV protons and also their dependence on the atio of the ranges of light and heavy fission fragments, l_π/l_T, for arious nuclear groups involving different excitation energies. The ependence of the fission yields on the range ratio was found not to ary monotonically for some nuclei. The dependence of the mean otal range of the fragments on l_π/l_T has been obtained. An explanaion of the experimental facts is suggested on basis of the shell tructure of the product nuclei.

539.17

.2694. FISSION-NEUTRON CROSS-SECTIONS FOR THRESHOLD REACTIONS. R.S.Rochlin.
Nucleonics, Vol. 17, No. 1, 54-5 (Jan., 1959).

Nucleonics data sheet No. 28. A compilation of effective cross-sections for (n,p), (n,α) and (n,2n) reactions, including exoergic reactions. Previously unpublished results for Cd, Co, Cu, Fe, Ge, Mn, Sc, and Zn are included. R.D.Smith

539.17

12695. FISSION CROSS-SECTION OF Pu^{240} BY FAST NEUTRONS.
V.G.Nesterov and G.N.Smirenkin.
Zh. eksper. teor. Fiz., Vol. 35, No. 2(8), 532-3 (Aug., 1958).
In Russian. English translation in: Soviet Physics—JETP (New York), Vol. 35(8), No. 2, 367-8 (Feb., 1959).

Measurements for neutron energies from 0.15 to 4 MeV and at 15 MeV show that the cross-section has a plateau of 1.50 ± 0.15 barns between 1 and 4 MeV. D.W.L.Sprung

539.17

12696. AVERAGE NUMBER OF NEUTRONS EMITTED IN THE FISSION OF Th^{229} BY THERMAL NEUTRONS.
V.I.Lebedev and V.I.Kalashnikova.
Zh. eksper. teor. Fiz., Vol. 35, No. 2(8), 535-7 (Aug., 1958).
In Russian. English translation in: Soviet Physics—JETP (New York), Vol. 35(8), No. 2, 370-1 (Feb., 1959).

The thorium sample extracted from U^{233} was carefully cleaned of uranium by chromatographic methods. The ratio $\nu(Th^{229})/\nu(U^{235})$ = 0.864 ± 0.008 was determined. This implies that the average number of emitted neutrons is $\nu(Th^{229})$ = 2.13 ± 0.03. D.W.L.Sprung

539.17

12697. ON SPONTANEOUS FISSION RATES. S.A.E.Johansson.
Nuclear Phys., Vol. 12, No. 5, 449-64 (Aug. (2), 1959).

An attempt is made to explain the irregular behaviour of the spontaneous fission half-lives. The influence of a single nucleon on the barrier height is calculated from the level scheme of Nilsson. It turns out that in many cases the single-particle effect changes the barrier height quite considerably compared with the smooth change expected from the liquid drop model. The calculated changes are compared with the experimental data. They account quantitatively for the irregularities in the spontaneous fission rates. Predictions of spontaneous fission half-lives are made for the heavier nuclei and the application of these predictions to some problems is discussed.

539.17 : 621.039

12698. A REVIEW OF WORK TOWARDS NUCLEAR ENERGY FROM CONTROLLED THERMONUCLEAR REACTION. D.W.Fry.
Proc. Instn Elect. Engrs, Paper 2903, publ. April, 1959 (Vol. 106A, 290-8).

Republication of the paper abstracted in Abstr. 5085 (1959).

539.17

12699. THE CATALYSIS OF NUCLEAR FUSION REACTIONS BY μ^--MESONS.
C.Hayashi, T.Nakano, M.Nishida, S.Suekane and Y.Yamaguchi.
Progr. theor. Phys., Vol. 17, No. 4, 615-17 (April, 1957).

An explanation of this process is given. Calculated results are consistent with experiment. R.J.N.Phillips

539.17 : 538.561

12700. RADIO EMISSION FROM AN ATOMIC EXPLOSION.
A.S.Kompaneets.
Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1538-44 (1958).
In Russian.

It is shown that in an atomic explosion in which gamma quanta are emitted asymmetrically, radiowaves are emitted due to the presence of a current in the ionized air. The duration of the oscillation in each half-wave is of the order of 10 μsec. For equal asymmetry of gamma-ray emission the amplitude of the oscillations weakly depends on the total emission.

539.17

12701. ARMY REACTOR PROGRAM.
Nucleonics, Vol. 17, No. 2, 46-54 (Feb., 1959).

A review of the small power reactors intended for supplying power at remote military sites. APPR-1 has operated well for nearly 2 years. Future projects include improved versions of APPR and ALPR and gas-cooled reactors. R.D.Smith

539.17

12702. TABULATION OF POWER AND RESEARCH REACTORS OF WEST GERMANY.
Nucleonics, Vol. 17, No. 2, 100-1 (Feb., 1959).

539.17

12703. A STATUS REPORT ON SDR.
E.Bernsohn, J.Duffy, C.K.Leeper and M.S.Silberstein.
Nucleonics, Vol. 17, No. 5, 112-15 (May, 1959).

The sodium—deuterium reactor has a heavy water moderator and a sodium coolant. The proposed design has a thermal output of 40 MW with a fuel load of 53 kg of U^{235} at 3% enrichment. The UO_2 fuel pellets are stainless steel clad and surrounded by stainless steel "hot tubes" containing the sodium coolant. These tubes are isolated from the water moderator by two aluminium carrier tubes. Tests have proved the feasibility of the water—sodium isolation method proposed. R.D.Smith

539.17

12704. RADIATION STABILITY OF DEUTERATED BERYLLIUM COMPLEX MODERATOR. M.A.Rollier and V.Maxia.
Nucleonics, Vol. 17, No. 5-162, 164 (May, 1959).

A deuterated basic beryllium acetate complex has shown sufficient thermal and radiation stability to be used as a reactor moderator and coolant. A γ-dose of 3×10^{22} eV in a 5g sample resulted in 1% decomposition. R.D.Smith

539.17

12705. ARMOUR DUST-FUELED REACTOR. D.Krucoff.
Nucleonics, Vol. 17, No. 6, 100, 102, 104, 105-6 (June, 1959).

Two reactors are suggested, one with graphite moderator,

uranium carbide fuel, helium as coolant and fuel dust carrier, and silicon carbide lined ducts, and the second with BeO moderator, UO_2 fuel, CO_2 coolant and Al_2O_3 lining. The gas has an inlet temperature of 1000° F and an outlet of 2500° F and carries 10 micron fuel particles through the core and heat exchangers. Good neutron economy and low processing costs are claimed. R.D.Smith

539.17

12706. REACTIVITY AND FLUX MEASUREMENTS IN THE MUNICH RESEARCH REACTOR [F.R.M.].
H.Hohmann, R.Misenta, M.Pollermann, T.Springer and H.Walther.
Nukleonik, Vol. 1, No. 4, 149-7 (Dec., 1958). In German.

Gives an account of reactivity and thermal, epithermal and fast-neutron flux measurements in the swimming pool reactor operating at low power. Additionally, details of the lattice arrangements and element loadings are given. C.G.Morgan

539.17

12707. ANALYSIS OF EBWR PERFORMANCE CLARIFIES THE FUTURE OF BOILING-WATER REACTORS.
J.M.West and G.M.Roy; J.M.Harrer.
Nucleonics, Vol. 17, No. 1, 42-8, 49 (Jan., 1959).

Operating at 60 MW, EBWR reached a power density of 70 kW/l in the coolant channels. By increasing the size and number of fuel assemblies it may be possible to increase the total heat output to 100 MW. Oxide fuel would be superior to metal fuel since it is not attacked by the coolant. Its lower density however, results in a lower power output for the same size core. Various possible core designs are considered and estimates made of the cost of a reactor power plant. R.D.Smith

539.17 : 536.24

12708. IMPROVING THE HEAT TRANSFER TO WATER BY USING ARTIFICIALLY ROUGHENED SURFACES IN REACTORS OR HEAT EXCHANGERS. G.Grass.
Atomkernenergie, Vol. 3, No. 8-9, 328-31 (Aug.-Sept., 1958).
In German.

Heat transfer and pressure drop in tubes were tested at different surface roughnesses. It is possible to improve the heat input to heat exchangers by a factor of 2-3 by using artificially roughened surfaces.

539.17 : 536.24

12709. THE TIME DEPENDENCE OF THE HEAT TRANSFER FROM THE FUEL ELEMENT TO A CONSTANT (BOILING) TEMPERATURE COOLANT IN THE CASE OF UNIDIMENSIONAL HEAT FLOW. A.Kirchenmayer.
Atomkernenergie, Vol. 3, No. 8-9, 337-41 (Aug.-Sept., 1958).
In German.

By making certain assumptions, the transfer function of the fuel element (ratio of the Laplace transform of the relative change of the heat flux crossing the surface of the fuel elements to the Laplace transform of the relative change of the power) is derived by applying the Fourier differential equation of heat conduction. This transfer function can be approximated, over a sufficiently wide range, by the function

$$Y(p) = 1/(1 + \Theta p).$$

The width of this range and the magnitude of the constant Θ depends upon the geometry, the local film heat-transfer coefficient and the thermal conductivity.

539.17 : 537.56

12710. ION CHAMBER CAN DETECT NUCLEATE BOILING.
L.R.Boyd.
Nucleonics, Vol. 17, No. 3, 96, 98, 100, 102 (March, 1959).

Voids in water-moderated reactors cause fluctuations in the signal in a nearby ion-chamber. Tests were made to determine the feasibility of using this effect to detect nucleate boiling in power reactors. These showed that boiling produced by an electrical heater in a low flux reactor could easily be detected. R.D.Smith

539.17

12711. COMPUTING AID FOR REACTOR-KINETICS EQUATIONS.
H.Smets.
Nucleonics, Vol. 17, No. 4, 104-5 (April, 1959).

Nucleonics Data Sheet No. 31. A graphical aid for computing the roots of the inhour equation or the exact response of a reactor to a ramp, exponential or inverse function of reactivity.
R.D.Smith

539.17

12712. PROGRESS REPORT ON SOLID FUELS.
Nucleonics, Vol. 17, No. 5, 100-3 (May, 1959).

Possible high temperature reactor fuels including oxide, carbic and cermets are reviewed and a summary of radiation experience with existing low temperature fuels given. R.D.Smit

539.17

12713. UO_2-FABRICATION AND PROPERTIES. O.J.C.Runnalls.
Nucleonics, Vol. 17, No. 5, 104-111 (May, 1959).

A review of the use of UO_2 for reactor fuel elements. Composition, compatibility with reactor materials, thermal conductivity, irradiation behaviour including fission-product release, and methods of fabrication including compacting and sintering are considered. A bibliography is included. R.D.Smit

539.17

12714. THERMAL-RESISTANCE CONCEPT AIDS FUEL-TEMPERATURE CALCULATIONS.
W.M.Rohsenhow, J.P.Barger and J.Lewins.
Nucleonics, Vol. 17, No. 5, 150, 152, 154, 157-159, 161 (May, 1959).

Details of a method of calculating the temperatures in a reacto fuel element. The method is applicable to flat or cylindrical fuel plates and depends on the use of pre-calculated thermal resistance for the fuel regions in the path of the heat flow. These resistances have been calculated and are tabulated. R.D.Smit

539.1

12715. RELATING BASIC CORE PARAMETERS. R.C.Walker.
Nucleonics, Vol. 17, No. 7, 68 (July, 1959).

Nucleonics Data Sheet No. 32. A nomogram relating core size, lattice spacing, specific tube power and number of process channel to reactor power. R.D.Smit

539.1

12716. THE INFLUENCE OF EFFECTIVE FRACTIONS OF DELAYED NEUTRONS ON THE SHORT-TERM BEHAVIOUR OF REACTORS. D.Emendörfer and A.Kirchenmayer.
Nukleonik, Vol. 1, No. 6, 233-6 (June, 1959). In German.

The effective fractions of delayed neutrons $\beta_{i\,eff}$, in the Frankfurt light water reactor, are calculated for six neutron groups. They are between 14 and 17% larger than the normal fraction β_i. The time behaviour of the reactor, when $\beta_{i\,eff}$ are used in the kinetic equations, is compared with that when β_i are used. It is shown that the modifications in the transition function and frequency variation are mainly caused by the difference in the total fractions of delayed neutrons. D.H.Lor

539.1

12717. ESCAPE OF VIRGIN NEUTRONS. R.Kladnik.
Nucleonics, Vol. 17, No. 7, 85-7 (July, 1959).

The flux of uncollided neutrons escaping from a reactor core o from a fuel rod can be calculated from the probability P that a neutron will escape from a cylinder of infinite length without collision. P can be calculated by expressing it as a convergent series and a table of coefficients for the first few terms of the series is given. R.D.Smit

539.17 : 614.89

REACTOR SHIELDING ANALYSIS. See Abstr. 11697

539.17 : 539.1.0

HALOGEN BETA-COUNTER MONITORS FOR CHALK RIVER REACTORS. See Abstr. 12518

ATOMS

539.1

12718. WAVE MECHANICS FOR HYDROGEN ATOM IN CYLINDRICAL COORDINATES: NON-SEPARABLE EIGENSOLUTIONS.
L.Gold.
J. Franklin Inst., Vol. 268, No. 2, 118-21 (Aug., 1959).

This solution serves to demonstrate the manner in which non-separable differential equations can be treated. The eigenvalues for the H atom are so deduced in a simpler fashion and the correspondence to the conventional spherical coordinate results is pointe out. In this manner the important matter of degeneracy is entered into; the quest for non-separable solutions must be characterized by appropriate attention to this detail.

539.18

719. THOMSON ATOM. S.T.Epstein.
ner. J. Phys., Vol. 27, No. 6, 430 (Sept., 1959).
Points out that the results found by Zatzkis (Abstr. 2855 of 1959) e incorrect.

539.18

2720. ELECTRON SCATTERING CROSS SECTIONS WITH ELATIVISTIC CORRECTION IN THE FIRST BORN APPRCXIMATION FOR THOMAS—FERMI AND HARTREE POTENTIALS. .Tietz.
cta phys. Hungar., Vol. 10, No. 1, 19-27 (1959).
The electron-scattering cross-sections are calculated which clude the effect due to relativity in the first Born approximation r Thomas—Fermi and Hartree potentials. The latter are approxnated by analytical fits. The electron-scattering cross-sections ithout relativistic correction agree quite well with the numerical esults of the exact Thomas—Fermi potential. A comparison is ade of electron-scattering cross-sections for approximate Thomas—ermi and approximate Hartree potentials with the exact numerical ta calculated from Hartree fields for argon. The analytical fits r Hartree fields do not differ essentially from the fits for the homas—Fermi potential. Nineteen fits are given of Hartree otentials for neutral atoms. An approximate formula is derived r the electron-scattering total cross-section which includes elativistic correction. The electron-scattering total cross-section ithout the relativistic correction, is given for argon for the homas—Fermi and Hartree potentials.

539.18

2721. ASYMPTOTIC HYDROGENIC MATRIX ELEMENTS AND AUNT FACTORS. B.H.Armstrong and H.P.Kelly.
. Opt. Soc. Amer., Vol. 49, No. 10, 949-508 (Oct., 1959).
Bound-free hydrogenic matrix elements and gaunt factors were omputed for initial principal quantum number $n_i = 4, 5, 6, 7, 8$, and r final principal quantum number $n_f \to \infty$. The calculation is performed by an asymptotic expansion of the hypergeometric function n the Coulomb matric element formula in which the first-order erms are confluent hypergeometric functions.

539.18

2722. APPROXIMATE CALCULATIONS RELATING TO THE ROUND STATE OF He I.
M.Dornstetter, G.Munschy and P.Pluvinage.
. Phys. Radium, Vol. 20, No. 1, 64 (Jan., 1959). In French.
Correction to Abstr. 9833 (1957), which had been based on rong data. The new value E=-2.903 627 is in better agreement with inoshita's (Abstr. 5574 of 1957). H.London

539.18

2723. ON THE SCHRÖDINGER EQUATION OF THE HELIUM ATOM. I-II. V.Fock.
K. Norske Vidensk. Selsk. Forhandl., Vol. 31, No. 22, 138-44; No. 23, 145-52 (1958; publ. 1959).
Translation by the author of his paper in Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 18, 161 (1954). A series expansion of the helium round state wave-function is derived which takes into account the ingularity corresponding to the triple collision. This is done in erms of hyperspherical coordinates (Fock 1935), (in four dimensions, f which only three have physical significance), related to the Hylleraas coordinates. The expansion is in terms of hyperspherical armonics and powers of R and ln (R), where R is the four-dimensional radius. A scheme for solution of the infinite set of equations erived is suggested; if carried out in a variational framework it hould give good convergence. [Pages 140 and 147 have been interhanged in the printing, as have pages 142 and 149]. J.Hawgood

539.18 : 530.145

2724. WAVE FUNCTION FOR THE FREE ELECTRON. . THE COULOMB POTENTIAL. R.G.Breene, Jr and M.C.Nardone.
Phys. Rev., Vol. 115, No. 1, 93-6 (July 1, 1959).
The wave-function for a free electron in the presence of an tom is considered for the case of the Coulomb potential, a potential hich ignores both the effects of electron exchange and core polarization. A sample calculation involving the neutral oxygen atom is arried through. From the single-determinant wave-function for the P ground state of this atom the Coulomb potential is developed, and he important parts of the potential for the s- and d-wave portions f the free-electron wave-function are considered. The relevant chrödinger equations are solved by means of an IBM 704 programme which is written so as to be readily adaptable to electrons in the presence of other atoms or ions having electrons through 2p. In this oxygen example the wave-function calculations were carried out for values of the free-electron linear momentum ranging from 0.01 through 0.80 atomic unit.

539.18

12725. ON MEASUREMENT OF THE 3^3P AND 3^1P LEVEL LIFETIMES OF HELIUM ATOMS BY THE DELAYED COINCIDENCE METHOD. A.L.Osherovich and I.G.Savich.
Optika i Spektrosk., Vol. 4, No. 6, 715-18 (June, 1958). In Russian. English summary: PB 141047T-11, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.
The method of Heron et al. (Abstr. 4589 of 1956) was applied to the 5016 A ($3^1P \to 2^1S$) and 3889 A ($3^3P \to 2^3S$) lines. The lifetime of the 3^3P level was found to be $(1.00 \pm 0.08) \times 10^{-7}$ sec, independent of pressure over the range 25 to 90 μ. The lifetime of the 3^1P level varied with pressure, but was found to be $(3.3 \pm 0.2) \times 10^{-8}$ sec at 10 μ. P.A.Young

539.18

12726. THE ABSOLUTE PROBABILITIES OF TRANSITIONS IN AN ATOM OF Tl. L.V.Gurvich.
Optika i Spektrosk., Vol. 5, No. 2, 205-7 (1958). In Russian. English summary: PB 141047T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.
It is shown that simple thermodynamic relations can be used to determine absolute values of the oscillator strengths from experimental investigation of the 3776 and 5350 A lines of Tl. Values calculated in this way agree well with theoretical predictions and the use is avoided of the inexact data on the saturated vapour pressure of Tl. The similar calculations with In show that the vapour pressure data were more reliable in this case. A.Ashmore

539.18

12727. ON THE RELATIVE PROBABILITIES FOR THE PHOTOEFFECT IN SHELLS AND SUBSHELLS OF AN ATOM.
E.P.Grigor'ev and A.V.Zolotavin.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 393-400 (1959). In Russian.
The relative intensities of the K, $L_I + L_{II}$, L_{III} and M + N photoelectron lines produced by γ-rays from some radioactive isotopes in various targets were determined with a β-spectrometer possessing a resolution of 0.4%. The results are compared with theoretical calculations.

539.18 : 530.145

HARTREE—FOCK THEORY WITH NONORTHOGONAL BASIS FUNCTIONS. See Abstr. 11851

539.18

12728. X-RAY YIELDS IN μ-MESONIC ATOMIC TRANSITIONS.
J.Bernstein and T.-Y.Wu.
Phys. Rev. Letters, Vol. 2, No. 9, 404-5 (May 1, 1959).
The observed low yield of K X-rays from μ-mesonic atoms has been accounted for in terms of a collisional de-excitation with neighbouring atoms (Abstr. 362 of 1958). This explanation is criticized by the authors who conclude that the anomalous experimental result remains unexplained. J.D.Dowell

539.18 : 539.12

FORMATION OF μ-MESIC ATOMS. See Abstr. 12574

539.18 : 533.15

12729. EXPERIMENTAL INVESTIGATION OF EFFICIENCY VARIATIONS VERSUS PRESSURE IN THE ISOTOPES SEPARATION BY GASEOUS DIFFUSION METHOD. G.Perona.
Energia nucleare, Vol. 5, No. 5, 327-31 (May, 1958).
Using an H_2—CO_2 mixture in a single stage diffusion unit the theory of Present and DeBethune (Abstr. 3017 of 1949) on the effect of the pressure ratio on separation efficiency is confirmed. It is shown that this theory is also valid for the separation of the uranium isotopes by gaseous diffusion in UF_6. H.C.Cole

539.18

12730. THE ISOTOPE EFFECT OF ELECTROLYTIC MIGRATION OF LITHIUM IONS IN MOLTEN LITHIUM BROMIDE AND IODIDE.
A.Lundén, S.Christofferson and A.Lodding.
Z. Naturforsch., Vol. 13a, No. 12, 1034-8 (Dec., 1958). In German.
The ratio of Li^7 to Li^6 was increased at the boundary between molten LiBr and $PbBr_2$ and similarly for LiI and PbI_2. The mass effect was -0.148 ± 0.014 for LiBr and 0.15 ± 0.02 for LiI. This value amends an earlier published value of the mass effect for LiBr (Abstr. 640 of 1957). H.C.Cole

539.18 : 535.41

12731. CALCIUM ATOMIC BEAM SOURCE AND INTERFERENCE BEYOND TWO METER RETARDATION.
K.W.Meissner and V.Kaufman.
J. Opt. Soc. Amer., Vol. 49, No. 10, 942-3 (Oct., 1959).

Fabry–Perot interference patterns of the resonance line of calcium, λ4226 A, have now been obtained at retardations of 153 and 204 cm by employing a highly collimated calcium atomic beam source in emission. The corresponding order numbers are 3.62 and 4.82 million. The appearance of these fringes suggests that the half-width of the line is less than 3×10^{-3} cm^{-1} which is one-fourth that of the proposed primary standard of length and one-tenth that of the present primary standard of wavelength. The use of an atomic beam source for the production of the length standard is discussed.

539.18 : 539.12

12732. PHOTOELECTRIC EFFECT FROM POLARIZED PHOTONS. I-II. H.Olsen.
K. Norske Vidensk. Selsk. Forhandl., Vol. 31, No. 11, 61-5; No. 11a, 66-70 (1958; publ. 1959).

A calculation of the photoelectric cross-section (from the K-shell) and electron polarization from arbitrarily elliptically polarized photons, in an approximation in which the final state electron wave-function is a Born approximation to the Dirac equation. J.C.Taylor

539.18

12733. FREQUENCY SHIFTS IN HYPERFINE SPLITTING OF ALKALIS CAUSED BY FOREIGN GASES.
H.Margenau, P.Fontana and L.Klein.
Phys. Rev., Vol. 115, No. 1, 87-92 (July 1, 1959).

The difference in the dispersion force between an alkali atom in a particular hyperfine level belonging to the ground state and a perturbing molecule is computed. These asymptotic forces, if active alone, generally produce red shifts and suffice to account for the results obtained for the heavier buffer gases. Experimental data exhibit blue shifts for the lighter gases and therefore indicate that the net frequency shifts are the result of exchange as well as dispersion forces. The former cannot be determined theoretically. Therefore, a simple model is devised in which the difference in the forces is given a positive trend at distances of separation smaller than d, while beyond d it is given the calculated form. The experimental data for all alkali–rare gas interactions can then be fitted by values of d which, for the different foreign gases, are of the order of their gas-kinetic diameters.

539.18

12734. He–He REPULSIVE POTENTIAL. S.Huzinaga.
Progr. theor. Phys., Vol. 71, No. 3, 512-13 (March, 1957).

The calculated potential curve is brought nearer to the experimental curve by a modification of the calculation of Abstr. 6346 (1955), allowing different exponents to AO's in the two MO's. J.Hawgood

539.18 : 537.56

IONIZATION PRODUCED BY ATOMIC COLLISIONS AT keV ENERGIES. See Abstr. 12399

MOLECULES

539.19

12735. DYNAMIC STABILITY OF FROZEN RADICALS. II. THE FORMAL THEORY OF THE MODEL. J.L.Jackson.
J. chem. Phys., Vol. 31, No. 3, 722-9 (Sept., 1959).

In Pt I (Abstr. 8700 of 1959), a model for frozen radical chain reactions of nitrogen atoms in a nitrogen molecule lattice was described. Here, a formal mathematical theory of these reactions is developed and applied. The results of the model are used to discuss the stability of frozen radical mixtures as a function of size. The theory is also used to obtain curves of free radical concentrations as a function of time, when radicals are produced by irradiation of the solid at low temperatures. The formulae obtained are compared with most recent experimental results.

539.19

12736. ORBITAL FOLLOWING IN TETRAHEDRAL MOLECULES.
L.Blum and N.V.Cohan.
Canad. J. Phys., Vol. 37, No. 9, 1002-7 (Sept., 1959).

On the basis of Heath and Linnett's formulae (1948), the "orbital following" force constants of NH_3- and NH_4^+-like molecules are calculated. The anomalous results are interpreted as a consequence of orbital deformation during the vibratory movement.

539.1

12737. EMPIRICAL CORRELATION BETWEEN MOLECULAR STRUCTURE AND ZERO-POINT ENERGIES IN HYDROCARBONS.
H.Shingu and T.Fujimoto.
J. chem. Phys., Vol. 31, No. 2, 556-7 (Aug., 1959).

Additivity rules for the zero-point energies of hydrocarbon molecules are deduced assuming a constant CH_2 increment with structural corrections. Calculated zero-point energies of paraffin, olefines, aromatics, and cycloparaffins are tabulated for comparis with recorded experimental data. G.I.W.Llewely

539.1

12738. LOCALIZED VIBRATIONS OF A PERTURBED DIATOMIC LINEAR CHAIN. O.Litzman.
Czech. J. Phys., Vol. 7, No. 6, 690-701 (1957). In Russian.

A regular diatomic chain is perturbed, the atoms at the points $2r + 1 \ldots 2r + l - 1$ being replaced by impurity atoms having masses $\mu_1 \ldots \mu_{l-1}$. Thus the original elastic constants β are changed to $\alpha_1 \ldots \alpha_l$. Frequencies are studied which lie above the optical spectrum (ultra-optic) and between the acoustic and optical spectra (ultra-acoustic).

539.19 : 535.34

12739. INTERNAL ROTATION IN DOUBLE INTERNAL ROTOR MOLECULES: THE MICROWAVE SPECTRUM OF DIMETHYL SILANE. L.Pierce.
J. chem. Phys., Vol. 31, No. 2, 547-8 (Aug., 1959).

Rotational transitions of $(CH_3)_2SiH_2$ and of $CD_3–SiH_2–CH_3$ are tabulated and interpreted. Barrier heights, C–Si bond length, and the C–Si–C angle have been calculated. G.I.W.Llewely

539.

12740. EFFECT OF CHANGE IN MOMENT OF INERTIA ON LIN INTENSITIES OF PARALLEL VIBRATION-ROTATION BANDS OF SYMMETRIC TOP MOLECULES. G.A.Gallup and J.L.Koenig.
J. chem. Phys., Vol. 31, No. 2, 548 (Aug., 1959).

Calculations of ξ_k, the Taylor's series coefficient in the expansion of the moment of inertia in terms of the normal coordinates, have been compared with values derived from experimental measurements of the parallel bands in the case of ammonia. Also $\Sigma\xi_k^2$ is compared with an independently determined experimental quantity, namely I_B^{-1}. Agreement in all cases is quite satisfactory. R.A.Balling

539.19 : 541.1

12741. HINDERED ROTATOR MODEL FOR ADSORBED HYDROGEN AT LOW TEMPERATURES. A.A.Evett.
J. chem. Phys., Vol. 31, No. 2, 565-6 (Aug., 1959).

An extension of the plane rotator model theory of Sandler (Abstrs. 7840 of 1954; 1820 of 1959) is proposed to explain the difference in ortho–para composition of adsorbed hydrogen compared with the gas phase at low temperatures. G.I.W.Llewely

539.1

12742. ENERGY LEVELS OF AN ASYMMETRIC ROTOR.
C.T.Fike.
J. chem. Phys., Vol. 31, No. 2, 568-9 (Aug., 1959).

Announces the existence of a limited table of these levels, and lists the advantages of the method used to find the characteristic roots of the matrices. J.Hawgo

539.

12743. STATISTICAL INTERPRETATION FOR ABNORMAL ROTATION OF OH* SPLIT FROM H_2O_2 BY ELECTRON IMPACT.
T.Horie, S.Watanabe and K.Kurata.
J. chem. Phys., Vol. 31, No. 3, 783-7 (Sept., 1959).

The angular momentum distribution of OH* split from H_2O_2 b electron impact or ultraviolet irradiation is quite abnormal in appearance. A statistical interpretation is presented of the relati population of the excited rotational levels of OH* in the dissociatio process of H_2O_2 into two hydroxyl radicals. The phase volume is calculated under the constraints of the conservation of energy, momentum, and angular momentum by the method using delta and step functions. A discrepancy which takes place beyond K = 24 between the calculated curve and the observational plots is attribu to the predissociation of OH*.

539.19

744. EXCITATION OF THE MOLECULAR VIBRATION BY OLLISION. K.Takayanagi.
Phys. Soc. Japan, Vol. 14, No. 1, 75-9 (Jan., 1959).
Excitation of molecular vibrations in $H_2 + H_2$ collisions was udied using the so-called modified wave-number method. The me problem was investigated by Salkoff and Bauer (Abstr. 761 of 59) who applied the distorted wave method thoroughly without aking the modified wave-number approximation. Thus the present ork serves as a test of the accuracy of the modified wave-number ethod which has been used by many authors to study this sort of oblem. The result obtained here is in good agreement with the sult of Salkoff and Bauer.

539.19

745. MOLECULAR CONSTANTS OF CARBONYL SULFIDE AND CORIOLIS PERTURBATION.
.D.Saksena, T.A.Wiggins and D.H.Rank.
chem. Phys., Vol. 31, No. 3, 839-42 (Sept., 1959).
The band origins and the changes in B and D for five bands of OS were measured. The highly precise values obtained are the sult of precise infrared measurements used in conjunction with icrowave results. The changes in B for the 002 and 003 bands ree with the reported value of α_3 from microwave measurements. ne other bands, members of resonating polyads, have anomalous lues of ΔB. The ΔD values also reflect this resonance. A Coriolis tational perturbation in the 003 band has been observed and anal- ed.

539.19

746. A PROGRAM FOR AUTOMATIC DIGITAL COMPUTATION F TRANSITION FREQUENCIES AND ANALYSIS OF MICROWAVE OTATIONAL SPECTRA OF RIGID ASYMMETRIC TOPS.
.Kneubühl, T.Gäumann and H.H.Günthard.
molecular Spectrosc., Vol. 3, No. 4, 349-62 (Aug., 1959).
An automatic digital computer programme for the analysis of tational transitions is described. Two problems are treated:) calculation of desired transitions with given J, K_{-1}, K_{+1} for bitrary rotational constants, and (2) evaluation of best-fitting tational constants from a number of measured transitions by the ethod of least squares. The programme reduces the time required r numerical calculation of a rotational spectrum to some hours. omparison with existing $E_T^J(\kappa)$-tables and application to the micro- ave spectra of cyclopentanone and ethylene oxide illustrate the ficiency of the programme.

539.19

747. AN INTERACTION THEORY OF THE VIBRATIONAL REQUENCIES OF ISOTOPIC MOLECULES. S.Brodersen.
molecular Spectrosc., Vol. 3, No. 4, 450-65 (Aug., 1959).
An attempt is made to survey the changes in vibrational equencies caused by isotopic substitution. The total effect is rmally divided into two different effects, one for the isolated equency and another due to the interaction between different fre- uencies. Simple expressions are given for both effects and fferent cases are considered in detail. The treatment is based the complete isotopic rule. The conditions for the validity of is rule in different cases are discussed. The correlation of brations in different isotopic species is considered in the light of e Rayleigh rule.

539.19 : 535.345

748. TRIATOMIC LINEAR MOLECULES CONTAINING CARBON ND OXYGEN, SULFUR, SELENIUM, OR TELLURIUM. III. BSOLUTE INTENSITY OF THE σ_3 BAND OF CSe_2.
.Wentink, Jr. and S.H.Bauer.
chem. Phys., Vol. 31, No. 3, 834-8 (Sept., 1959).
For Pt II, see Abstr. 3977 (1959). The rate of change of the xial dipole moment with asymmetric bond extension in carbon iselenide has been computed from the measured gas-phase infrared bsorption intensity of the σ_3 fundamental band. The absolute inten- ity was measured by the pressure-broadening technique, using itrogen or air as the foreign gas. The magnitudes of $d\mu/dr$ for O_2, OCS, CS_2, and CSe_2 are compared. Also, the absorption inten- ity of the σ_3 band of CSe_2 dissolved in CS_2 was measured.

539.19 : 535.34

SHAPE OF THE ABSORPTION AND EMISSION BANDS OF OMPLEX MOLECULES. See Abstr. 12025

539.19 : 535.34

A THEORY OF THE HYPERFINE STRUCTURE OF ROTATIONAL SPECTRA OF SYMMETRICAL-TOP MOLECULES. See Abstr. 12026

539.19 : 535.343

VIBRATIONAL ASSIGNMENT FOR PYRROLIDINE. See Abstr. 12052

539.19

12749. QUADRUPOLE COUPLING AND BOND STRUCTURE IN ReO_3F, ReO_3Cl, AND MnO_3F. J.F.Lotspeich.
J. chem. Phys., Vol. 31, No. 3, 643-9 (Sept., 1959).
A theoretical explanation is offered to account for the magnitude and sign of the quadrupole coupling constants in ReO_3F, (Abstr. 12056) ReO_3Cl, and MnO_3F. Subject to the requirement that the valence electron bonding orbitals of Re and Mn have a tetrahedral configuration, a combination of s, p, and d atomic orbitals is chosen which tends to minimize the energies of bond formation. Results of the analysis reveal that, in order to account for the observed quadrupole couplings, the effect of atom core polarization must be considered. It is shown in particular that the contribution to the electric field gradient at the Re nucleus from the polarized electron core is more than 25 times that of the external polarizing ions themselves. Comparison of the quadrupole coupling in ReO_3F with that of atomic Re shows that the amount of unbalanced p electron along the molecular symmetry axis is nearly zero and thus provides a reasonable explanation for the pronounced dependence of eqQ(Re) on the state of molecular vibration.

539.19 : 538.2

DIAMAGNETIC SUSCEPTIBILITY OF POSITION ISOMERS. See Abstr. 12445

539.19

12750. NOTE ON THE SIMPLE UAO—MO CALCULATION OF THE CH_5^+ ION. J.Higuchi.
J. chem. Phys., Vol. 31, No. 2, 563-4 (Aug., 1959).
Energy calculations have been made on the $CH_4—H^+$ ion to explain the variation of the measured proton affinities of various saturated molecules. G.I.W.Llewelyn

539.19

12751. ELECTRONIC WAVE FUNCTIONS FOR POLYATOMIC MOLECULES. L.C.Allen.
J. chem. Phys., Vol. 31, No. 3, 736-7 (Sept., 1959).
A one-electron basis set, made from functions with exponential and Gaussian radial dependence, is proposed for constructing many-electron, many-centre, electronic wave-functions. Appropriate mixtures of these two types may greatly simplify the evaluation of many-centre, two-electron integrals and in addition make possible an improved description of the molecular bond. Plane waves may also be added to the basis set thus making an application to solids appear feasible.

539.19

12752. THE ELECTRONIC STRUCTURE OF THE PROTONATED METHANE CH_5^+ . M.Yamazaki.
J. Phys. Soc. Japan, Vol. 14, No. 4, 498-510 (April, 1959).
The electronic structure of the ground state of CH_5^+ was studied by the Heitler—London—Slater—Pauling method extended by Voge and by Kotani and Siga. The wave-functions were constructed without the assumption of the electron pair bond, taking $(2s)^2(2p)^2$, $(2s)(2p)^3$, and $(2p)^4$ configurations of the carbon atom into account. Assuming a probable model for this ion, seventeen $^1A_1'$ states were obtained. The energy matrix for these states was computed by means of the representation matrices of the symmetric group. By solving the secular equations thus obtained for two different sets of parameters, the binding energy (or the proton affinity) and the equilibrium proton—carbon distance are estimated.

539.19 : 535.343

12753. CARBON-13 NUCLEAR RESONANCE SPECTRUM AND LOW-FREQUENCY INFRARED SPECTRUM OF IRON PENTACARBONYL. F.A.Cotton, A.Danti, J.S.Waugh and R.W.Fessenden.
J. chem. Phys., Vol. 29, No. 6, 1427-8 (Dec., 1958).
The spectra were measured in an attempt to decide whether the molecule has a trigonal bipyramidal or a square-base pyramidal structure. The nuclear resonance of C^{13} in natural abundance in the liquid is a single line and does not fit the predictions on either model.

The infrared vibrational spectrum, taken with the Raman data of Stammreich, are more nearly consistent with the trigonal structure.
E.F.W.Seymour

539.19

12754. RAPID PROCEDURE FOR RIGOROUS ANALYSIS OF ELECTRON DIFFRACTION DATA. R.A.Bonham and L.S.Bartell.
J. chem. Phys., Vol. 31, No. 3, 702-8 (Sept., 1959).

A refined procedure for the analysis of electron diffraction patterns of gas molecules has been developed and programmed for rapid computation by the IBM 650 digital computer. In addition to increasing greatly the speed and accuracy of data processing, it reduces to routine practicability the most rigorous methods of structural analysis presently available. Improved methods for handling standard electron diffraction computations and several new schemes facilitating molecular structure determinations are given including an objective determination of parameters by the method of steepest ascents. A simplified means of estimating standard errors is developed.

539.19 : 535.343

STRUCTURE OF ReO_3F. See Abstr. 12056

539.19

12755. CALCULATION OF THE QUADRUPOLAR FIELD OF THE HCl MOLECULE. L.Galatry and F.Schuller.
J. Phys. Radium, Vol. 20, No. 5, 573-4 (May, 1959). In French.

Arising from previous work [C.R. Acad. Sci. (Paris), Vol. 248, No. 13, 1974 (April 1, 1959)] on the influence of dispersion interactions on the displacement of infrared bands of HCl, the quadrupole moment of HCl is calculated. It is suggested that a more precise calculation would permit determination of the hybridization of valence electrons.
R.C.Seymour

539.19 : 535.343

ELECTRIC DIPOLE MOMENT OF GASEOUS NO. See Abstr. 12054

539.19 : 537.226.1

DIELECTRIC SATURATION AND MOLECULAR STRUCTURE. See Abstr. 12204

539.19 : 537.226.1

THEORY OF DIELECTRIC ABSORPTION DUE TO ROTATIONAL OSCILLATIONS IN CRYSTALLINE LONG CHAIN SUBSTANCES. See Abstr. 12205

539.19 : 537.226.2

INTRAMOLECULAR DIPOLE MOTION IN AMINES AND ETHERS FROM DIELECTRIC MICROWAVE MEASUREMENTS ON DILUTE SOLUTIONS. See Abstr. 12216

539.19 : 537.226.2

DIELECTRIC PROPERTIES OF SOME PHENOLS. See Abstr. 12218

539.19 : 548.737

12756. MOLECULAR STRUCTURE OF $B_{10}H_{12}(CH_3CN)_2$.
J.van der Maas Reddy and W.N.Lipscomb.
J. chem. Phys., Vol. 31, No. 3, 610-16 (Sept., 1959).

An X-ray diffraction study of single crystals of $B_{10}H_{12}(CH_3CN)_2$ has yielded the positions of all atoms, including hydrogen atoms. The structure is regarded as a substitution derivative of the $B_{10}H_{14}^{-2}$ structure having C_{2v} symmetry, two bridge hydrogens and two BH_2 groups. A B—N single bond replaces a B—H of each BH_2 group and the acetonitrile residue is linear with normal bond distances, except for $C—CH_3$ = 1.45 A in agreement with $C—CH_3$ = 1.46 A in acetonitrile itself. The unit cell is monoclinic, of symmetry I2/c, and has parameters a = 7.81, b = 11.31, c = 14.18 A, and $\beta = 96^\circ 52'$. Final values of R = 0.15 and r = 0.12 were obtained.

539.19

12757. INTERACTIONS BETWEEN OXYGEN AND NITROGEN: O—N, O—N_2, and O_2—N_2.
J.T.Vanderslice, E.A.Mason and W.G.Maisch.
J. chem. Phys., Vol. 31, No. 3, 738-46 (Sept., 1959).

Potential energy curves for O—N interaction corresponding to $X\ ^2\Pi_{1/2}$, $X\ ^2\Pi_{3/2}$, $A\ ^2\Sigma^+$, $B\ ^2\Pi$, $C\ ^2\Pi$, $D\ ^2\Sigma^+$, $E\ ^2\Sigma^+$, and $B'\ ^2\Delta$ states of nitric oxide have been calculated from spectroscopic data by the Rydberg—Klein—Rees method. Curves for the $^4\Pi$, $^2\Sigma$, $^4\Sigma$, $^6\Sigma$, and $^6\Pi$ states have been obtained from limited spectroscopic results and from relations derived from approximate quantum-mechanical calculations. Two semi-independent calculations were made, and are in good agreement with each other. The quantum-mechanical relatio also lead to approximate curves for the O—N_2 and O_2—N_2 interacti over a limited range. The O_2—N_2 interaction is consistent with on valid at larger separation distances which was derived from high-temperature gas viscosity data.

539.1

12758. MASS SPECTROMETRIC STUDY OF ALKALI HYDROXID VAPORS. R.C.Schoonmaker and R.F.Porter.
J. chem. Phys., Vol. 13, No. 3, 830-3 (Sept., 1959).

A mass spectrometer was used to analyse the vapours effusin from the orifice of a Knudsen cell containing pure and mixed alkal hydroxide condensed phases. Monomeric and dimeric species are detected in all cases except for LiOH in the temperature range 650-900° K. Thermochemical data are reported for the reactions

$$2MOH(g) = M_2(OH)_2(g), \text{ and } M_2(OH)_2(g) + N_2(OH)_2(g) = 2MN(OH)_2(g),$$

where M and N represent constituent alkali metals. The analogous behaviour of the vaporization processes of alkali fluorides and hydroxides is discussed.

539.19 : 576.

INTERACTION PROPERTIES OF ELONGATE PROTEIN MACROMOLECULES WITH PARTICULAR REFERENCE TO COLLAGEN (TROPOCOLLAGEN). See Abstr. 11667

539.19 : 539.2

12759. INVESTIGATION OF FREE RADICALS FORMED IN SOLIDS DURING FAST ELECTRON BOMBARDMENT.
Yu.N.Molin, A.T.Koritskii, N.Ya.Buben and V.V.Voevodskii.
Dokl. Akad. Nauk SSSR, Vol. 123, No. 5, 882-3 (1958). In Russian.

To study very short-lived free radicals, an apparatus was constructed which records electron paramagnetic resonance spectra during irradiation. The electron beam of energy 1.6 MeV passes through a channel in one of the pole pieces of the magnet. The temperature of tablet-shaped samples may be varied between −100° and +150° C by a stream of cold or hot air. Several polyme solid organic acids and salts, and aromatic compounds were irrad ted. The radical $-CH_2—CH—CH_2-$, which is unstable at room temperature, was observed during the irradiation of polyethylene.
J.Ad

SOLID-STATE PHYSICS

539.2 : 535.343 : 537.5

BINDING ENERGY OF Ce—Al ALLOYS. See Abstr. 12348

539

12760. LATTICE DISTORTIONS DUE TO D—S MIXING.
L.E.Orgel.
J. Phys. Chem Solids, Vol. 7, No. 2-3, 276 (Nov., 1958).

Qualitative group-theoretical considerations suggest that the anomalous X-ray scattering in halides and sulphides containing Cu^+, Ag^+, Hg^{++}, etc., may be due to d—s mixing in the T_1 stretchi vibration.
J.Hawgo

539

12761. THE PROBLEM OF IONS IN CRYSTALS. L.Khrobak.
Kristallografiya, Vol. 3, No. 2, 235-6 (1958). In Russian.

In the ionic model of the structure of a crystal, the electric field and its gradient are assumed spherically symmetrical aroun each ion. Owing to the small size of electrons and protons compared with the ions, the field must, in fact, be anisotropic, and a simple model is described to illustrate this effect.
R.F.S.Hearm

539

12762. ENERGY PROBLEMS ON THE INCORPORATION OF FOREIGN IONS IN IONIC CRYSTALS. P.Brauer.
Semiconductors and phosphors. (See Abstr. 9597 of 1959) 63-80. In German.

The energy of formation of lattice defects, due to the incorpo tion of foreign ions in ionic crystals, is calculated using the meth of Mott and Littleton (Abstr. 1708 of 1938), adapted for non-perio problems. The method is applied to some special cases.
J.Fran

539.2 : 537.311.33

DISORDER PROPERTIES OF SILVER IODIDE. See Abstr. 12256

539.2

763. MULTIPLE SLIP IN BICRYSTALS. J.P.Frankel.
cta metallurgica, Vol. 6, No. 3, 215-16 (March, 1958).

Livingston and Chalmers [Acta metallurgica, Vol. 5, No. 6, 322 une, 1957)] use the principle of macroscopic continuity to predict e number of active slip systems in deformed bicrystals. This is ot justified, as regions of macroscopic homogeneity in the vicinity grain boundaries probably do not exist. An alternative criterion r the activation of slip can only be expressed in thermodynamic rms. B.T.M.Willis

539.2

764. MULTIPLE SLIP IN BICRYSTALS.
D.Livingston and B.Chalmers.
cta metallurgica, Vol. 6, No. 3, 216 (March, 1958).

The criticism of Frankel (see preceding abstract) is met. acroscopic continuity is preserved, provided grain-boundary ieering is not an important mode of deformation. The con- tion of macroscopic continuity then gives the minimum number active slip systems. B.T.M.Willis

539.2

765. THE MICROSTRUCTURE OF STRAINS IN LINES OF SLIP ND DISLOCATION. V.L.Indenbom and G.E.Tomilovskii.
okl. Akad. Nauk SSSR, Vol. 123, No. 4, 673-6 (Dec. 1, 1958).
Russian.

It is shown theoretically and experimentally that the optical ethod of observing the polarization pattern from the regions of a rystal near a slip line is a practicable method of studying disloca- ons and can be used not only for examining the atomic structure of ip lines but also for solving other problems which require the udy of the mechanisms of collective displacements of atoms in rystals. Estimates are given for NaCl, LiF, TlBr, TlI and Al_2O_3 the sensitivities of the method. The distances between disloca- ons at which the birefringence jump reaches 10^{-4} are, for the bove materials, 0.22, 0.52, 3.4, 3.4 and 6.4 μ. A.L.Mackay

539.2

766. DISLOCATION ETCH PITS IN TUNGSTEN. U.E.Wolff.
cta metallurgica, Vol. 6, No. 8, 559-61 (Aug., 1958).

Dislocation etch pits were produced by etching with a reagent parts of 25% $CuSO_4$ solution and 1 part conc. NH_4OH) developed Millner and Sass [Aluminium (Budapest), Vol. 5, 214 (1953)]. he formation of the pits was related, by X-ray examination, to e orientation of the grains. J.Thewlis

539.2

767. DISLOCATION ETCH PITS IN TELLURIUM.
C.Lovell, J.H.Wernick and K.E.Benson.
cta metallurgica, Vol. 6, No. 11, 716-20 (Nov., 1958).

Single crystals were etched with polish-etch solution and the etch ts examined microscopically and by X-rays. It was concluded at the pits were dislocation sites. The slip direction was in doubt t was thought to be $[11\bar{2}0]$. J.Thewlis

539.2

768. FORMATION OF SCREW DISLOCATIONS BY THE NCOUNTER OF TWO LAYERS SPREADING OVER THE SURFACE F A CRYSTAL. M.I.Kozlovskii.
ristallografiya, Vol. 3, No. 2, 236-7 (1958). In Russian.

The formation of screw dislocations by the growth of one layer ver another is discussed and illustrated by frames from a cine lm. R.F.S.Hearmon

539.2

769. ACTIVATION ENERGY AND RELAXATION SPECTRUM F DISLOCATIONS IN COPPER.
G.Bordoni, M.Nuovo and L.Verdini.
hys. Rev. Letters, Vol. 2, No. 5, 200-2 (March 1, 1959).

Attenuation measurements between 1.8 kc/s and 6.5 Mc/s were ade on polycrystalline Cu (grain size 6×10^{-2} mm). The relation etween frequency and temperature is given by $\omega = \omega_A \exp(-W/kT)$. he activation energy W has the same value for all dislocations .122 ± 0.005 eV (molecule)$^{-1}$], there is a wide spectrum of values r ω_A. J.Franks

539.2 : 536.21 : 537.311.3

770. ELECTRICAL AND THERMAL RESISTIVITY OF DISLOCATIONS. P.Carruthers.
Phys. Rev. Letters, Vol. 2, No. 8, 336-8 (April 15, 1959).

It is suggested that the scattering of electrons by the strain field of an edge dislocation may be much larger than found in previous calculations, and in fact large enough to account for the reduction of conductivity by dislocations. The theory is similar to a theory of the Author (to be published) of the scattering of phonons by the strain field. Recent experimental results agree with this theory of the thermal resistance of dislocations. L.Pincherle

539.2

771. CONSIDERATIONS ON THE INTERACTIONS BETWEEN THERMAL VACANCIES AND DISLOCATIONS.
H.G.F.Wilsdorf and D.Kuhlmann-Wilsdorf.
Phys. Rev. Letters, Vol. 3, No. 4, 170-2 (Aug. 15, 1959).

It is found that deformation of Al, previous to its being thinned for the examination of the movement of dislocations in the electron microscope, affects the phenomena observed. For example, the smooth dislocation lines normally observed are replaced by intricate tangles of kinked and branching dislocations with interspersed loops. This and other phenomena are explained in terms of the interaction of dislocations with aggregates of up to a hundred vacancies each. J.Thewlis

539.2

772. ENERGY OF FORMATION AND DISPLACEMENT OF VACANCIES IN GOLD AND PLATINUM.
B.G.Lazarev and O.N.Ovcharenko.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 60-7 (1959). In Russian.

For gold and platinum, values of $(19.0 \pm 0.5) \times 10^3$ cal/mole and $(27 \pm 0.5) \times 10^3$ cal/mole were respectively obtained for the energy of vacancy production, and $(20 \pm 1) \times 10^3$ and $(25 \pm 1) \times 10^3$ cal/mole for their energy of displacement. These data were obtained on basis of data on the variation of the electric resistance of metals due to quenching of the vacancies.

539.2 : 537.226.2

DIELECTRIC PROPERTIES OF ICE IN TERMS OF CRYSTAL DEFECTS. See Abstr. 12210

539.2 : 538.27

DISLOCATIONS IN NaI AND KI. See Abstr. 12499

539.2 : 537.311.3

773. THE DETECTION OF IMPURITIES IN SINTERED TUNGSTEN BARS AND WIRES BY MEANS OF MEASUREMENTS OF RESIDUAL RESISTANCE. E.Krautz and H.Schultz.
Tech. wiss. Abhandl. Osram-Gesell., Vol. 7, 259-68 (1958).
In German.

The addition of Al_2O_3 has a strong effect on the residual resistance of tungsten filaments for electric bulbs, showing that the aluminium remains included in the W lattice. The effect was used to detect the regions with different Al concentrations in sintered W specimens. The main result is that the Al is bound primarily on the surface of the grains, mainly at corners. L.Pincherle

539.2

774. CALCULATION OF THE LATTICE VIBRATIONS IN CRYSTALS WITH THE ZINC BLENDE STRUCTURE. L.Merten.
Semiconductors and phosphors (see Abstr. 9597 of 1959).
pp. 587-92. In German.

The frequency v. wave-number relations of the optical and acoustical branches are given for the [111] and [100] directions. The theoretical values of the reststrahl wavelength for ZnS and InSb are within 30% of the observed values. B.T.M.Willis

539.2

775. LOCALIZED VIBRATIONS IN A SIMPLE CUBIC LATTICE: ONE IMPURITY ATOM, INTERACTION WITH SIX NEAREST NEIGHBOURS. O.Litzman.
Czech. J. Phys., Vol. 8, No. 6, 633-46 (1958).

Criteria are calculated for the production of localized vibrations in a simple cubic lattice in which one atom is replaced by an impurity atom. The exact criteria are compared with the approximate criteria.

539.2

776. VIBRATION FREQUENCY SPECTRA OF DISORDERED LATTICES. I. MOMENTS OF THE SPECTRA FOR DISORDERED LINEAR CHAINS.

C.Domb, A.A.Maradudin, E.W.Montroll and G.H.Weiss.
Phys. Rev., Vol. 115, No. 1, 18-24 (July 1, 1959).

By using the theory of random walks on lattices, a combinatorial expression has been obtained for the even moments of the vibrational frequency spectrum of a randomly disordered, two-component, isotopic linear chain as functions of the concentrations of the two kinds of particles and of their mass ratio. Expressions for the even moments up to μ_{30} are presented.

539.2

12777. VIBRATION FREQUENCY SPECTRA OF DISORDERED LATTICES. II. SPECTRA OF DISORDERED ONE-DIMENSIONAL LATTICES. C.Domb, A.A.Maradudin, E.W.Montroll and G.H.Weiss.
Phys. Rev., Vol. 115, No. 1, 24-36 (July 1, 1959).

By using a combination of the moment-trace method and a new method, the "delta-function" method, the vibrational frequency spectrum of a randomly disordered, two-component, isotopic, linear chain has been computed for a wide range of the concentrations of the two kinds of particles and of their mass ratios. In addition the particular case of a chain in which the mass of one of the isotopic constituents becomes infinite can be treated exactly, and the results of this analysis shed light on the form of the spectra for lattices with large but finite mass ratios for the two constituents. The spectra are characterized by the disappearance of the square-root singularity at the maximum frequency which is found in ordered one-dimensional lattices, and by the appearance of impurity bands, the nature of which is discussed. Finally, the zero-point energy of a randomly disordered lattice is calculated and compared with the zero-point energy of an ordered lattice and of the separated phases.

539.2

12778. IMAGE OF THE FERMI SURFACE IN THE VIBRATION SPECTRUM OF A METAL. W.Kohn.
Phys. Rev. Letters, Vol. 2, No. 9, 393-4 (May 1, 1959).

The vibration of the ions in a metal are partly screened by the conduction electrons. This screening changes rapidly on certain surfaces in the space of phonon q-vectors, therefore on these surfaces the phonon frequency ω varies abruptly with q and in fact $|\text{grad}\ \omega(q)| = \infty$. The location of such surfaces is entirely determined by the shape of the electronic Fermi surface and can be found by a geometrical construction. Thus observation of the effect in lattice vibration spectra may give fairly direct information on the shape of the Fermi surface. Similar "images" of the Fermi surface may be expected in spin wave spectra if the interaction between the localized spins is brought about by exchange with conduction electrons. L.Pincherle

539.2 : 537.311.31

ANISOTROPY OF LATTICE VIBRATION SPECTRUM OF COPPER. ELECTRICAL CONDUCTIVITY CALCULATION. See Abstr. 12236

539.2

12779. COMPARISON OF THE DEBYE θ DETERMINED FROM ELASTIC CONSTANTS AND CALORIMETRY.
G.A.Alers and J.R.Neighbours.
Rev. mod. Phys., Vol. 31, No. 3, 675-80 (July, 1959).

The elastic constant data for calculating the values of θ_0, the Debye characteristic temperature at 0°K, for several materials, together with the values of θ_0 calculated by various methods, are listed. The calculated values are compared with the values of θ_0 determined from specific heat measurements in the 1 to 4°K range. Some, as yet, unpublished results are included. For the cubic materials considered there is good agreement between the elastic constants and calorimetric θ's, but not for Au and the hexagonal metals. S.Weintroub

539.2

12780. ON THE WIDTH OF THE 3d ELECTRON BAND IN IRON. M.Suffczyński.
Acta phys. Polon., Vol. 16, No. 1-2, 161-4 (1957).

The simplified tight-binding calculation of Slater and Koster takes into account only nearest-neighbour interactions. The width of the 3d band turns out to be 2.47 eV in this case. The calculation is extended in this paper to include nearest- and next-nearest-neighbour interactions, and this leads to a width of 2.88 eV. The effects on the curves of energy along directions in k-space are also discussed. P.T.Landsberg

539

12781. THE NUMERICAL VALUES OF THE TWO-CENTRE INTEGRALS FOR 3d ELECTRONS IN TRANSITION METALS. M.Suffczyński.
Bull. Acad. Polon. Sci. Ser. Sci. math. astron. phys., Vol. 7, No. 5, 285-7 (1959).

The integrals were calculated for Fe, Co, Ni, Cu and Zn with Lowdin-type analytic wave-functions fitted to numerical Hartree–Fock functions; their values were very sensitive to the smallest exponent, describing the tails of the functions. See Abstr. 7584, 8468 (1956); 564, 5492 (1957). J.Hawgo

53

12782. ENERGY BANDS IN SILICON CRYSTALS. F.Bassani.
Nuovo Cimento, Vol. 13, No. 1, 244-5 (July 1, 1959).

The method of Orthogonalized Plane Waves is used to calculat new results for the energy values at two more points of the reduce zone. These results are presented and discussed. P.T.Landsbe

539.2 : 537.5

12783. ELECTRONIC BAND STRUCTURE OF SOLIDS BY X-RA SPECTROSCOPY. L.G.Parratt.
Rev. mod. Phys., Vol. 31, No. 3, 616-45 (July, 1959).

A review of experimental and theoretical work with an empha "upon current (and perhaps future) problems of interpretation". Considerable space is devoted to the best form of energy level dia grams to be used. The review does not claim to be exhaustive as regards the presentation of experimental data, but there are sec- tions on Na, Mg and Al; Ni, Cu and Zn; KCl. P.T.Landsbe

539.2 : 535

DETERMINATION OF THE FORBIDDEN BAND WIDTH OF SEMICONDUCTORS AND INSULATORS BY DIFFUSE REFLEC TION. See Abstr. 12132

539

12784. INTERACTION WITH THE SOUND QUANTA IN A SYSTE CONSISTING OF TWO KINDS OF CHARGED PARTICLES. THE METHOD OF SUPPLEMENTARY VARIABLES. Z.Galasiewicz.
Progr. theor. Phys., Vol. 17, No. 4, 613-15 (April, 1957).

Application of the method of supplementary variables makes possible to transform the Hamiltonian of systems composed of tw kinds of particles, interacting through central forces, into a form in which there appear terms describing interaction of electrons with phonons. L.Pincher

53

12785. THEORY OF ELECTRON–PHONO INTERACTIONS. D.G.Whitfield.
Phys. Rev. Letters, Vol. 2, No. 5, 204-5 (March 1, 1959).

The electron–phonon interactions are discussed with refere to a new set of basic states. These are given by Bloch functions which deform with the lattice. A generalized deformation potenti theorem, and a Boltzmann equation for the diagonal elements of t density matrix can be derived. P.T.Landsbe

53

12786. NEW LOOK AT THE THEORY OF ELECTRON–PHONO RESONANCE. I. W.Band.
Amer. J. Phys., Vol. 27, No. 6, 397-403 (Sept., 1959).

In order to give a clear physical picture of the meaning of electron–phonon resonance, this paper develops the quantum mec anics of an electron in a linear lattice capable of longitudinal vib tions.

53

12787. ON THE RADIATIONLESS TRANSITIONS OF ELECTRO IN THE LATTICE OF SULPHIDE PHOSPHORS EXCITED IN THE LONG WAVELENGTH TAIL OF THE ABSORPTION. M.Schön.
Tech. wiss. Abhandl. Osram Gesell., Vol. 7, 185-93 (1958).
In German.

In a previous paper [Ibid. Vol. 6, 49-68 (1953)] the non-linea relation between luminescence and excitation intensity is establi for excitation of the bulk lattice. In this paper absorption in the of the lattice band is considered. Two transitions are considere that from activator centre to conduction band and that from valenc band to trapping states. In both cases the absorption falls off wit rise in excitation intensity since centres are emptied and traps f Theoretical equations are derived for the composite excitation pr cesses. G.F.J.Garl

539.2 : 77.01

788. ELECTRONIC AND IONIC PROCESSES IN SILVER ALIDE CRYSTALS. O.Stasiw.
miconductors and phosphors (See Abstr. 9597 of 1959) 306-16. German.

Photochemical reactions in silver halides are discussed. The ocesses involve the release and trapping of electrons and the fusion of interstitial silver ions. J.Franks

539.2

789. MOTION OF POSITIVE HOLES IN SILVER BROMIDE. A.Hamm.
appl. Phys., Vol. 30, No. 9, 1468-9 (Sept., 1959).

The motion of positive holes in an electric field through a Br crystal was detected by their bleaching action on an evapora- d Ag layer. The drift mobility is 0.5 cm^2/V sec and the lifetime μsec. J.Franks

539.2

790. ON THE RATIO OF PROBABILITIES OF CAPTURE AND ECOMBINATION OF ELECTRONS IN KCl-Tl CRYSTALS. P.Shchukin.
ptika i Spektrosk., Vol. 5, No. 2, 200-2 (1959). In Russian.
nglish summary: PB 141047T-5, obtainable from Office of echnical Services, U.S. Dept. of Commerce, Washington, D.C., S.A.

This ratio was studied for sparsely filled capture levels, by taining the thermal stimulation curve produced when F-centres e destroyed. It was found that re-capture may be more important an recombination, particularly above room temperature, the obabilities being equal for 10% filling of the levels at 100°C. An planation in terms of the association of a pair of oppositely arged ionic vacancies to form a capture centre is suggested. J.Hawgood

539.2 : 535.343

791. ON THE INTERACTION OF THE ELECTRONS WITH THE CTIVATOR IN NaCl:Ni AND NaCl:Cu PHOSPHORS. A.Parfianovich.
ptika i Spektrosk., Vol. 4, No. 5, 692-5 (1959). In Russian.
nglish summary: PB 141047T-2, obtainable from Office of Tech- cal Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Introduction of Ni or Cu into NaCl intensifies the F- and V- nds. In NaCl:Ni new absorption bands occur at 234, 253, 276, 308 d 340 mμ. The 276 and 308 mμ bands may be electronic in nature, they are intensified by de-excitation of the F-band. In NaCl:Cu ditional bands occur at 212, 234, 290 and 335 mμ, of which the first ree are intensified by de-activation of the F-band. B.T.M.Willis

539.2 : 537.311.33

DRIFT MOBILITY OF ELECTRONS IN SILVER CHLORIDE. e Abstr. 12255

539.2

792. THEORY OF STATIONARY AND NON-STATIONARY TATES OF EXCITONS IN POLAR CRYSTALS. H.Haken.
miconductors and phosphors (see Abstr. 9597 of 1959) pp. 565-7. German.

Expressions are given for the resonance interaction of an ectron-hole pair in a stationary lattice, and the free flight time of exciton when scattering occurs due to lattice vibrations. J.Franks

539.2

793. KINETIC PARAMETERS OF A FREE EXCITON FOR ERTAIN TYPES OF MOLECULAR CRYSTALS. A.S.Selivanenko.
ptika i Spektrosk., Vol. 4, No. 1, 122-4 (Jan., 1958). In Russian.
nglish summary: PB 141047T-3, obtainable from Office of echnical Services, U.S. Dept. of Commerce, Washington, D.C., S.A.

The formulae obtained in Abstr. 11562 (1959) are applied to phthalene. The calculated mean free path of the excitons is $^{-4}$ cm, and the mean time between exciton–phonon collisions is $\times 10^{-9} T^{-1/2}$ sec, T being the absolute temperature. J.Hawgood

539.2

794. THE MEAN FREE PATH OF AN EXCITON IN A MOLEC- LAR CRYSTAL. V.M.Agranovich and Yu.V.Konobeev.
ptika i Spektrosk., Vol. 6, No. 2, 242-5 (Feb., 1959). In Russian.

The mean free path of a "non-localized" (free) exciton inter- cting with the acoustical branch of lattice vibrations was calcu- ted. For the cubic lattice, when the interaction with only the nearest neighbours is considered and the effective exciton mass approximation is used, a value of 20 A was obtained for the mean free path of an exciton in a molecular crystal under the conditions of thermal equilibrium at 300°K. The diffusion coefficient of excitons was found to be ~ 1 cm^2/sec. This value is one order higher than the published values obtained by direct measurement. The difference between the observed and calculated diffusion coefficients may be due either to the effect of the "localized" excitons, or to lattice defects distributed in such a way that the distances between them are less than the calculated value of the exciton mean free path A.Tybulewicz

539.2 : 530.162

12795. ON THE STATISTICS OF SPIN AND POLAR EXCITATIONS IN CRYSTALS. S.V.Vonsovskii and M.S.Svirskii.
Zh. eksper. teor. Fiz., Vol. 35, No. 6 (12), 1447-56 (1958).
In Russian.

The question regarding the type of statistics of quasi-particles (the elementary excitations of the spin and electron systems of a crystal) is discussed.

539.2

12796. ELECTROMAGNETIC WAVES IN A CRYSTAL IN THE REGION OF EXCITON ABSORPTION.
A.S.Davýdov and A.F.Lubchenko.
Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1499-507 (1958).
In Russian.

A theory is developed which yields the absorption coefficient and refractive index in the absorption bands corresponding to exciton excitations in molecular crystals at low temperatures. It is shown that the structure of the absorption band may be used to determine the sign of the effective exciton mass. Conditions are found which yield a zero refractive index at the short wave side of the excitation band. Electromagnetic waves of these frequencies are reflected from the surface of the crystal and enter to a very small depth only. This effect disappears with increase of temperature.

539.2 : 537.226.1

THEORY OF DIELECTRIC RELAXATION IN MOLECULAR CRYSTALS. See Abstr. 12203

539.2

12797. DEFORMATION POTENTIAL IN GERMANIUM FROM OPTICAL ABSORPTION LINES FOR EXCITON FORMATION.
W.H.Kleiner and L.M.Roth.
Phys. Rev. Letters, Vol. 2, No. 8, 334-6 (April 15, 1959).

If a sample of Ge is sheared, the valence band edge is shifted and splits into two edges. There will then be two exciton levels, one associated with each valence band edge. A theory is given of the phenomenon and it is shown that the splitting and shift measured for appropriate shears can be used to obtain information about the deformation potential coefficients for the band edge. L.Pincherle

539.2

12798. ELECTRONMICROSCOPIC OBSERVATION OF THE ADDITIVELY COLOURED KCl CRYSTAL. T.Hibi and T.Tomiki.
J. Phys. Soc. Japan, Vol. 14, No. 4, 445-55 (April, 1959).

KCl single crystals which were grown from the melt, thermally quenched, and additively coloured with potassium metal were observed electron-microscopically using replica technique. Growth of crystallites was seen both on the outer surfaces and in the interior of the crystal when it was thermally quenched or coloured additively. The crystallites grew more markedly in the latter case than in the former. The mechanism by which F-centres are formed were considered.

539.2

12799. SUCCESSIVE ELECTRONMICROSCOPIC OBSERVATION OF COLOURED AND BLEACHED KCl CRYSTALS
T.Hibi and K.Yada.
J. Phys. Soc. Japan, Vol. 14, No. 4, 455-63 (April, 1959).

The surface changes in a given part of the same KCl crystal during coloration by X-rays and in the process of bleaching by natural light were successively observed using the two-stage replica technique. A slightly modified Bradley's method was used for making two-stage replicas. By this method, the surface change at a definite position of the same KCl crystal was observed successively. It was confirmed that crystallites grown on the KCl crystal during X-ray coloration disappear during bleaching through a process quite reverse to the crystal growth in coloration, and that the behaviour of

the crystal growth and its disappearance are not simple, but very peculiar. The results obtained are briefly discussed.

539.2

12800. FREQUENCY SPECTRUM OF DOUBLE SPIN-RESONANCE AT COLORATION CENTRES IN ALKALI-HALIDE CRYSTALS. V.Ya.Zevin.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 116-28 (1959). In Russian.

The dependence of the frequencies of double spin resonance on the orientation of the crystal in an external static magnetic field was found for U_2,F_2^+ and M-centres in alkali halide crystals. The angular dependences are determined by the structure of the centre and can be employed for a direct experimental study of the structure of the colour centre by the double spin-resonance method.

539.2 : 535.37

COLOUR CENTRES. QUANTUM MECHANICAL MODEL. See Abstr. 12077

539.2 : 535.37

12801. EXTERNAL QUENCHING ACTIVATOR INTERACTION, AND WANDERING OF HOLES IN THE ZnS:Cu AND ZnS:Cu,Co PHOSPHORS. M.Fock.
Semiconductors and phosphors (see Abstr. 9597 of 1959) pp. 593-601. In German.

A band model with "blue" and "green" centres is discussed. These centres are assumed to have equal recombination cross-sections for electrons, but different probabilities for the release of holes. It is also assumed that the number of ionized centres is only a small proportion of the total number, but that the numbers of free electrons and holes are much smaller still; also the number of filled electron traps is a small proportion of the whole, though the probability of trapping of an electron is much greater than for recombination. Agreement is shown between experiment and the predictions for steady state blue or green band luminescence, and for the form of the decay processes with excitation in either type of centre. Low temperature excitation of the blue band by light of 4358 A requires that this light should release holes from ionized centres. If the probability of hole capture by the centres is greater than that for hole recombination with trapped electrons, then hyperbolic decay will follow even with added strong infrared quenching, as observed for ZnS:Cu,Co. The linear relation between steady fluorescence and excitation intensity becomes increasingly superlinear (up to a slope of 3/2) with increasing infrared. The stimulation effect of the emitted light also has some effect. S.T.Henderson

539.21

12802. EFFECT OF LOW ENERGY ARGON IONS ON URANIUM SURFACES. P.Haymann.
C.R. Acad. Sci. (Paris), Vol. 248, No. 17, 2472-4 (April 27, 1959). In French.

The surface of uranium which had been bombarded at grazing incidence by argon ions accelerated by a potential of 10 000 V was examined by electron diffraction and the results related to ionic density and time of bombardment. The part played by the oxide film remains to be established. J.Thewlis

539.21

12803. CORRELATED COLLISIONS IN A DISPLACEMENT SPIKE. G.Leibfried.
J. appl. Phys., Vol. 30, No. 9, 1388-96 (Sept., 1959).

The influence of correlated collisions due to lattice structure is investigated for f.c.c. lattices and discussed in detail for Cu. The model used is that of Silsbee (Abstr. 8450 of 1958) in which the assumed exponential potential between atoms gives approximately hard core collisions. Two possibilities which may cause long-range effects are investigated: (1) focusing collisions, which are suggested do not effect an interstitial transport; (2) crowdion-like collisions with interstitial transport. The number of such collisions, as well as their range, is calculated for given energy of a primary knock on. The result shows that the range should be determined by the focusing collisions only. The theoretical range (about 100 atom spacings) is in agreement with the experimental value derived out of the damping experiments in Cu. The effect of crowdion collisions on disordering is discussed for Cu_3Au.

539.21 : 537.311.33

12804. ON THE THEORY OF THE SPECTRAL DEPENDENCE OF THE QUANTUM EFFICIENCY OF HOMOPOLAR CRYSTALS. E.Antončík.
Czech. J. Phys., Vol. 7, No. 6, 674-89 (1957).

A low-energy theory is developed on the basis of the Tewordt—Franz theory of electron impact ionization in insulators. The general conclusions are illustrated using the results of measurements on silicon and germanium. The results of measurements on other materials can be satisfactorily interpreted by this theory.

539.2

12805. EFFECT OF ELECTRON BOMBARDMENT ON SODIUM CHLORIDE. S.Yoshida and T.Ikeda.
J. Phys. Soc. Japan, Vol. 14, No. 4, 473-7 (April, 1959).

The absorption spectra from 360 to 960 mμ were measured on rock salt crystals bombarded with electrons at various temperatures. Three types of colour centres, namely F, 590 mμ and colloidal centres were formed as a function of specimen temperature during bombardment. The thermal bleaching of these three colour centres was also investigated. From the results it is supposed that the colour centre with an absorption peak at about 590mμ may correspond to a precursor of colloidal sodium. It is also suggested that there may be a correlation between coloration and dissociation of sodium chloride by electron bombardment.

539.2

12806. ENERGY DEPENDENCE OF RECOVERY IN IRRADIATED COPPER. J.W.Corbett and R.M.Walker.
Phys. Rev., Vol. 115, No. 1, 67-70 (July, 1, 1959).

Stage I recovery (14°K-65°K) in electron-irradiated copper consists of five substages of recovery, designated as I_A-I_E in orde of increasing temperature. The shift in the populations of I_A-I_E is reported as a function of the energy of the bombarding electrons. The sum of the first three substages (I_A, I_B, and I_C) increases with decreasing bombarding energy at the expense of the higher tempera ture substages. The ratio I_D/I_E also increases with decreasing energy. The data are interpreted as corroboration of a previously proposed model for stage I recovery. The measured shifts are quit small. This discussed in relation to the recoil energy distributions and it is concluded that the most likely interpretation is that the average separation between a primary recoil and its vacancy does not vary rapidly with increasing recoil energy near threshold. Several possible explanations for this behaviour are outlined.

539.21 : 539.1

FREE RADICAL FORMATION IN SOLIDS DURING ELECTRON BOMBARDMENT. See Abstr. 12759

539.21

12807. INVESTIGATION OF CAPTURE CENTRES OF X-RAY IRRADIATED QUARTZ WITH THE INTRODUCTION OF Na IONS. E.N.Batrak.
Kristallografiya, Vol. 3, No. 1, 104-6 (1958). In Russian.

Observations are reported on the thermoluminescence of smok quartz containing Na ions. Expressions are given for the energy of thermal ionization, and for the probability of transition from one state to another, in terms of the temperature of maximum luminescence and the half-width of the intensity—temperature curve. R.F.S.Hearmo

539.2

12808. NATURE OF RADIATION DAMAGE IN NICKEL. H.G.F.Wilsdorf.
Phys. Rev. Letters, Vol. 3, No. 4, 172-3 (Aug. 15, 1959).

Ni foils were irradiated by neutrons to an integrated flux of 10^{19} and then deformed by about 2%. They were then polished to a thickness of 1000 A and examined in the electron microscope. The resulting micrographs showed tangles of dislocations and loops which are interpreted as arising from the interaction of dislocation with aggregates of vacancies produced by irradiation. J.Thewli

539.2

12809. FISSION FRAGMENT DAMAGE IN ZIRCONIA. M.C.Wittels and F.A.Sherrill.
Phys. Rev. Letters, Vol. 3, No. 4, 176-7 (Aug. 15, 1959).

Monoclinic ZrO_2, contrary to previously published results by t same authors (Abstr. 6249 of 1956), is stable under fast neutron bombardment. The change to cubic ZrO_2 previously reported is du to the action of fission fragments arising from fissile impurities in the sample. A "fission spike" mechanism is considered to be prob able, and it appears that about 10^6 atoms are affected by each fissio fragment. The results are based on X-ray single crystal (precessi and powder photographs. J.Thewli

539.21 : 538.

RADIATION DAMAGE BY HIGH POLYMERS STUDIED BY N.M.R. See Abstr. 12498

STRUCTURE OF SOLIDS

539.211

810. ELECTRON DIFFRACTION STUDY ON POLISH LAYERS OF GOLD. II. M.Kuriyama.
Phys. Soc. Japan, Vol. 14, No. 4, 487-92 (April, 1959).

The polished layer of gold was examined by means of the transmission method of electron diffraction. The diffraction pattern from the highly polished layer of gold (the Beilby layer) consists of three rings (see Abstr. 8908 of 1957). The radial distribution function of atoms in the layer was calculated by Fourier transformation of the observed intensity. The observed intensity was compared with those calculated from appropriate models of atomic arrangement. It was found that the Beilby layer has an amorphous arrangement in which the first and the second coordination number are about 10 and 8, respectively.

539.213.22

2811. THE CALCULATION OF STRESSES INDUCED IN GLASS BY QUENCHING. P.G.Kalman.
Soc. Glass Technol., Vol. 43, 211T-233T (June, 1959).

A theory is given which permits the calculation of the transient thermal stresses in chilled glass, and hence of the permanent stresses existing after temperature equalization, utilizing an assumption made by Bartenev. The nature of this assumption is discussed. Two simple examples are given.

539.217

2812. NEW SOLUTIONS TO THE DIFFUSION EQUATION. W.Waring.
Semiconductor Prod., Vol. 2, No. 7, 29-34 (July, 1959).

The general analogue technique used in solving diffusion equations is presented, together with solutions to three particular problems: the effect of later heating (double diffusion) on an initial diffusion; diffusion from a liquid alloy dot in through a regrown region to a bulk semiconductor material; and diffusion through a region with one value of the diffusion coefficient into a region with a different value. The application of the results to semiconductor device design, fabrication, and analysis are indicated.

539.217 : 537.311.33

2813. THE DIFFUSION OF IMPURITIES IN SILICON. D.A.Petrow, J.M.Schaschkow and A.S.Belanovski.
Semiconductors and phosphors (see Abstr. 9597 of 1959) pp. 652-5. In German.

The diffusion of radioactive Sb^{124} in Si was measured at different temperatures and for Si of varying degrees of purity. With increasing purity (or rather electric resistance) of the samples, the diffusion coefficient decreases and the activation energy for diffusion increases. Results are compared with available data for other impurities. L.Pincherle

539.217

2814. A STUDY OF THE SURFACE CONDITIONS DURING THE DIFFUSION OF AN IMPURITY INTO SILICON. G.Feuillade.
C.R. Acad. Sci. (Paris), Vol. 248, No. 22, 3136-8 (June 1, 1959). In French.

After the definition of the physical variables and of the boundary conditions which govern diffusion, the study shows that the diffusing impurities are divided into three groups according to the nature of the physicochemical reactions which they cause at the surface. D.J.Huntley

539.217

2815. DIFFUSION OF ALUMINUM, MAGNESIUM, SILICON, AND ZIRCONIUM IN NICKEL. H.W.Allison and H.Samelson.
J. appl. Phys., Vol. 30, No. 9, 1419-24 (Sept., 1959).

The diffusion rates of these elements, alloyed as single additives in nickel, have been measured at temperatures between 800° and 1270°C. The method consisted of measuring the weight gain caused by surface oxidation of the additive in a wet hydrogen ambient. The surface oxides were identified by electron diffraction. Grain size was about 0.05 mm in Al—Ni, Si—Ni, and Mg—Ni but less than 10^{-3} mm in Zr—Ni. The composite volume and grain boundary diffusion coefficients are given by $D_{Al\rightarrow Ni} = 1.1\exp(-59\,500/RT)$; $D_{Mg\rightarrow Ni} = 2.3\times10^{-5}\exp(-31\,300/RT)$; $D_{Si\rightarrow Ni} = 10.6\exp(-64\,800/RT)$; $D_{Zr\rightarrow Ni} = 1\times10^{-5}\exp(-26\,700/RT)$. Stereo and photomicrographs indicate considerable grain boundary diffusion, particularly in Mg—Ni and Zr—Ni.

539.217 : 537.311.33

12816. DIFFUSION OF RADIOACTIVE ANTIMONY IN SILICON. J.J.Rohan, N.E.Pickering and J.Kennedy.
J. Electrochem. Soc., Vol. 106, No. 8, 705-9 (Aug., 1959).

The diffusion coefficient of radioactive Sb^{124} in Si was investigated in the temperature range 1190° to 1398°C, using a technique involving measurement of the residual integrated activity of the 0.602 MeV gamma before and after removing successive 2- to 4-μ layers perpendicular to the diffusion path. Results are compared to literature data obtained via p—n junction measurements. The diffusion coefficients are on the average about 85% higher than the literature values, while the activation energies are essentially the same. The temperature dependence of the diffusion coefficient is given by $D \approx 12.9\exp(-91\,700/RT)$ cm^2 sec^{-1} with an average error of ±12%. Surface concentrations of Sb were in the range of 10^{19} to 10^{20} atoms cm^{-3}.

539.217

12817. GROWTH AND DISSOLUTION OF PORES IN CRYSTALS. R.I.Garber, V.S.Kogan and L.M.Polyakov.
Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1364-8 (1958). In Russian.

The time dependence of the diffusion processes of sintering and coalescence of pores in rock salt has been determined experimentally. The results satisfactorily agree with the theoretical formulae of Lifshitz and Slyozov. Numerical values of the parameters characterizing diffusion in rock salt have been determined. It is shown that sintering occurs not only as a result of solution of the pores and direct exit of the vacancies on the free surface but also via an intermediate stage in which the vacancies accumulate on macrodefects with subsequent formation of large "negative crystals" on the latter. Coalescence of pores has been observed by annealing single crystals of metallic samples, the method of preparation of which (distillation in vacuum, iodide method etc.) was the cause of the initial small porosity.

539.217 : 537.311.33

SURFACE EFFECTS ON THE DIFFUSION OF IMPURITIES IN SEMICONDUCTORS. See Abstr. 12251

539.219

12818. AN INVESTIGATION OF THE SYSTEM SnTe—GeTe. N.Kh.Abrikosov, A.M.Vasserman and L.V.Poretskaya.
Dokl. Akad. Nauk SSSR, Vol. 123, No. 2, 279-81 (1958). In Russian.

Thermal, microscopic and X-ray analyses showed that a continuous range of solid solutions is formed between SnTe and GeTe, the crystal lattice becoming progressively more rhombohedrally distorted with increase in GeTe. There is a minimum in melting point near 80 wt.% GeTe. A minimum in electrical conductivity ($< 10^{-3}$ ohm^{-1} cm^{-1}) was observed near 50 wt.% GeTe. Low thermoelectric powers (< 35 μV/deg) were obtained. Specimens were prepared by slow cooling in sealed silica tubes, followed by prolonged annealing. C.H.L.Goodman

539.219 : 537.226.2

12819. ELECTRICAL AND X-RAY INVESTIGATION OF THE SYSTEM $BaTiO_3$—$BaZrO_3$. T.N.Verbitskaya, G.S.Zhdanov, Yu.N.Venevtsev and C.P.Solov'ev.
Kristallografiya, Vol. 3, No. 2, 186-96 (1958). In Russian.

Solid solutions of $BaTiO_3$—$BaZrO_3$ were studied at concentrations between 0 and 30 mol % $BaZrO_3$. The existence of tetragonal, pseudomonoclinic, orthorhombic and cubic modifications, corresponding to increasing $BaZrO_3$ concentration, was established, and the cell dimensions measured as a function of concentration. The effect of temperature and field strength on dielectric constant was measured at various concentrations. The phase constitution diagram and the effect of composition on the phase transition temperature were also obtained. R.F.S.Hearmon

539.219 : 669

12820. PROPERTIES OF ZIRCALOY-2. L.S.Rubenstein.
Nucleonics, Vol. 17, No. 3, 72-6 (March, 1959).

Nucleonics Data Sheet No. 30. A compilation of corrosion, mechanical and physical properties of Zircalloy-2 (Zr containing 1.5% Sn, 0.12% Fe, 0.05% Ni and 0.10% Cr by weight). R.D.Smith

539.231

12821. ON THE NON-LINEAR CHARACTER OF THE INTENSITY DEPENDENCE OF CATHODIC SPUTTERING AT HIGH ENERGIES AND ITS VARIATION WITH TEMPERATURE. C.Cassignol and G.Ranc.
C.R. Acad. Sci. (Paris), Vol. 248, No. 13, 1988-90 (April 1, 1959). In French.

For copper bombarded with cadmium ions of 30 keV energy the ratio of the numbers of sputtered atoms to incident ions was greater than unity in the regions of high ionic density and less than unity in the regions of low density. This observation is explained in terms of a thermal annealing mechanism for copper, which takes place between successive ionic collisions.

B.T.M.Willis

539.232

12822. THE GROWTH OF BARRIER OXIDE FILMS ON ALUMINUM. W.J.Bernard and J.W.Cook.
J. Electrochem. Soc., Vol. 106, No. 8, 643-6 (Aug., 1959).

The growth of anodically formed barrier oxide films on aluminium was followed by weight, capacitance, and rate measurements. The increase of film thickness at constant voltage was calculated and compared to the values obtained by optical measurements. The results were shown to obey the law $i = \alpha e^{\beta F}$.

539.234

12823. TEXTURE OF EVAPORATED NiFe THIN FILMS. R.R.Verderber.
J. appl. Phys., Vol. 30, No. 9, 1359-63 (Sept., 1959).

The texture of 28 evaporated NiFe thin films, of various compositions, were determined by the Geiger counter X-ray reflection technique. The grain orientation of the thin films is described by one of the following three textures; random, [111] fibre axis, or a [311] fibre axis. The development of a texture was influenced by the temperature of the substrate during deposition. The coercive force and the selectivity, which is a measure of the slope of the sides of the hysteresis loop, of the films were measured on a 60 cycle hysteresis loop tracer. Only the selectivity was found to be related to the texture of the films. Films with a [311] fibre axis has a selectivity less than 0.5, while films with a [111] fibre axis had a selectivity of 0.5 or greater.

539.234

12824. COMPARATIVE STUDY OF THE EFFECT OF SILVER PRE-COATS ON THE TEXTURE OF ZINC AND CADMIUM FILMS CONDENSED FROM VAPOUR IN VACUO. V.R.G.Moorti and M.K.Gharpurey.
Optik, Vol. 15, No. 8, 481-4 (Aug., 1958).

The texture of films condensed in vacuo at low vapour beam flux densities on to plastic substrates having silver pre-coats ($\sim 10^{-3}$ - 10^{-1} A average thickness of Ag) were examined electron microscopically. It is concluded that each silver crystallite in the pre-coat can nucleate either zinc or cadmium equally well. It is also found that the rate of deposition of the silver pre-coat does not appreciably influence the zinc and cadmium film textures.

539.27

12825. SCATTERING OF COLD NEUTRONS BY MANGANESE FLUORIDE (MnF_2). D.Cribier, M.Ericson, B.Jacrot and G.Sarma.
C.R. Acad. Sci. (Paris), Vol. 248, No. 11, 1631-4 (March 16, 1959). In French.

Reports measurements of the scattering of 4.5 A neutrons by powdered MnF_2 at 20° C and 320° C. Graphs are given showing (1) the energy distribution of neutrons scattered through 23°; (2) the half-width of the energy distribution plotted against momentum transfer for scattering angles less than 30°. Graph (2) agrees with the theoretical curve of De Gennes (Abstr. 2599 of 1959). The energy distribution for scattering through 90° was also measured and the experimental width is only one-fifth of that expected theoretically.

D.M.Edwards

539.27

12826. SOME REMARKS ON THE ACCURACY OBTAINABLE IN ELECTRON STEREOMICROSCOPY. R.I.Garrod and J.F.Nankivell.
Optik, Vol. 16, No. 1, 27-9 (Jan., 1959).

The accuracy with which vertical elevations may be determined is dependent upon a number of factors. Helmcke and Orthmann (Abstr. 2785 of 1955) have suggested, however, that the decisive factor is the accurate calibration of the stereoangle. In the present communication it is shown that this latter conclusion is invalid, and that, for small elevations, the principal source of error may well be that due to tilting of the specimen. Consideration of the possible errors suggests that, for relative elevations in excess ~ 1000 A, the accuracy is unlikely to be better than 5% and becomes rapidly worse for smaller elevations.

539.2

12827. LONG PATH INTERFERENCES (MOIRÉ PATTERNS) OF ELECTRON WAVES AS ABBE "OBJECTS". O.Rang and H.Poppa.
Z. Phys., Vol. 153, No. 5, 643-52 (1959). In German.

Bragg reflection of electrons by overlapping crystal lattices can give rise to a moiré pattern in the electron microscope, and additional spots in the diffraction pattern. These may be thought of as primary and secondary interference images in the Abbe sense. This is demonstrated by bright and dark field patterns of gold crystals.

A.E.I. Research Laboratory

539.2

12828. INTERFERENCE MICROSCOPY WITH ELECTRON WAVES. R.Buhl.
Z. Phys., Vol. 155, No. 4, 395-412 (1959). In German.

The electron interferometer of Möllenstedt was modified for microscopy. In one version a reversed biprism (at negative potenti is placed between object and objective, forming a suitable system fo imaging relatively extended regions at low magnification. A second arrangement, in which a normal biprism (at positive potential) is placed after the objective, is better for high magnification of small areas of the object. At a direct electron optical magnification of 2000 × and a beam voltage of 50 kV, the width of the object plane ov which interference occurred amounted to 1.5 micron. The phase sh at the edges of thin films, or where film thickness or material changed, was demonstrated in micrographs reproduced at various magnifications between 7600 and 16 000 ×. The method was used to determine the inner potential of a number of substances, which were evaporated on to a thin supporting film of carbon. Their thickness was measured by the Tolansky multiple beam optical interferometer and mean values for the inner potential were found to be: Au, 21.1 ± 2 V; Ag, 20.7 ± 0.7 V; Al, 12.4 ± 1 V; ZnS, 10.2 ± 0.5 V.

V.E.Cosslett

ELASTICITY . STRENGTH . RHEOLOGY

539.32 : 548.737

12829. ELASTIC PROPERTIES OF THE GUANIDINE ALUMINIUM SULPHATE HEXAHYDRATE GROUP. S.Haussühl.
Fortsch. Mineral., Vol. 37, No. 1, 69-71 (July, 1959). In German.

The cell dimensions, the densities, the six elastic stiffnesses and their temperature coefficients, measured by the Schaefer–Bergmann method, are reported for guanidine A.R. hexahydrate, where A may be Al or Ga, and R may be SO_4 or SeO_4. All four substances are highly anisotropic, the ratio of the stiffnesses c_{11}/c_{33} being about 3 : 1.

R.F.S.Hearmon

539.32 : 548.736.5

12830. THE ELASTICITY OF ALUMS. S.Haussühl.
Fortschr. Mineral., Vol. 36, No. 1, 75-77 (July, 1958). In German.

Values are reported for the densities, the lattice constants and the elastic stiffnesses C_{11}, C_{12} and C_{44} of 20 alums of the type $ABR_2.12H_2O$, where A may be K, Rb, Cs, NH_4, Tl or CH_3NH_3; B may be Al, Ga, In or Fe; and R may be SO_4 or SeO_4. The results are discussed briefly in relation to composition and other physical properties.

R.F.S.Hearmon

539.32

12831. ELASTIC CONSTANTS OF α BRASSES: VARIATION WITH SOLUTE CONCENTRATION FROM 4.2-300° K. J.A.Rayne.
Phys. Rev., Vol. 115, No. 1, 63-6 (July 1, 1959).

Elastic constant measurements have been made on a representative series of α-brasses in the temperature range 4.2-300° K. No appreciable change with temperature occurs in the dependence of C and C' on solute concentration. Possible explanations for this result are considered. The Θ values for the alloys, as computed fo the elastic-constant data at 4.2° K, differ significantly from the calorimetric values. It is believed that this discrepancy results from the difference between the phonon wavelengths used in the ultrasonic measurements and those contributing to the lattice heat capacity of the alloys at low temperatures.

539.32

12832. ELASTIC PROPERTIES OF ARTIFICIAL GRAPHITE. R.Arnold.
Z. angew. Phys., Vol. 11, No. 5, 179-83 (May, 1959). In German.

The results of mechanical tests on artificial graphite and carbon s described. The graphite, like carbon, behaved elastically up to point of fracture and its Poisson ratio was 0.22. The author's re-ts for the different moduli were inter-related satisfactorily using expression derived by Filon. H.J.H.Starks

539.32

833 INTERNAL FRICTION AS A CONSEQUENCE OF A RE-DERING PROCESS. H.Stiller.
n. Phys. (Leipzig), Folge 7, Vol. 3, No. 5-6, 283-97 (1959). German.

Using a torsion method, measurements of internal friction were de on alloys of Ag–Pt, Ag–Mn, Ag–Zn, Ag–Mg and Au–Cd at peratures between 20° and 500° C. In Ag–Zn, Ag–Mg and Au–Cd, maxima were found in the range, which were related to possible chanisms involving the re-arrangement of pairs of solute atoms. Ag–Pt and Ag–Mn such maxima were not observed and the solute ms were assumed to be statistically distributed. J.Thewlis

539.37

834. PHYSICOCHEMICAL PHENOMENA DURING DEFORMA-ON OF METALS. V.I.Likhtman and E.D.Shchukin.
pekhi fiz. Nauk, Vol. 66, No. 2, 213-45 (1958). In Russian.

Review. The subjects dealt with include stress-strain curves, eep and mode of fracture of metal crystals; the formation of cks by concentrations of dislocations, and its connection with cture. 69 references. R.F.S.Hearmon

539.37 : 531.6

ELASTIC AND PLASTIC BEHAVIOUR IN THE IMPACT OF LINDERS AGAINST PLATES. See Abstr. 11871

539.373

835. SLIPPING OF BERYLLIUM SINGLE CRYSTALS AT LOW EMPERATURES. R.I.Garber, I.A.Gindin and Yu.V.Shubin.
n. eksper. teor. Fiz., Vol. 36, No. 2, 376-84 (1959). In Russian.

Especially pure (99.98%) beryllium single crystals were formed at 20° and 77° K. Slipping along the basis plane (0001) was tected at 20° as well as at 77° K. Two deformation stages are scerned: an initial stage when the displacement occurs in a thin yer adjacent to the slip band and a later stage when the deforma-on is localized at the slip band. In regions between the bands a isting has been detected which increases with the deformation. he twist of the blocks in the early stages may be ascribed to the fect of residual strains. In the later stages when the rotation aches 3°, one is forced to assume that twinning takes place during ipping. The large magnitude of the relative displacement in the cond stage may be explained by violation of continuity with sub-quent restoration of the contacts.

539.374

836. LIGHT INDUCED PLASTICITY IN GERMANIUM.
C.Kuczynski and R.H.Hochman.
appl. Phys., Vol. 30, No. 2, 267 (Feb., 1959).

Single crystal plates of germanium, containing less than 10^2 slocation pits per cm^2, were fractured in darkness and under illumi-tion from a 150 W lamp. Subsequent etching showed that in dark-ss brittle fracture occurred with no increase of dislocation density, hereas under illumination the dislocation density near the crack in-eased to 10^5-10^6 per cm^2, indicating that some plastic flow took ace before fracture occurred. B.T.M.Willis

539.374

837. INVESTIGATION OF LATTICE DEFECTS IN COLD-ORKED TUNGSTEN BY MEANS OF RESIDUAL-RESISTANCE EASUREMENTS. H.Schultz.
. Naturforsch., Vol. 14a, No. 4, 361-73 (April, 1959). In German.

The formation of lattice defects in tungsten by plastic deforma-on at room temperature, and their disappearance at higher tem-eratures, was investigated by the measurement of residual resist-ance at liquid hydrogen temperature. The effect of defects on resist-ance is larger in tungsten than in any other metal so far examined. Here is appreciable recovery between 300° and 400° C, with an acti-tion energy of 1.73 eV per atom. Between 400° and 1100° C recrys-llization sets in. The effect of grain boundaries on the movement lattice holes has also been investigated. A.R.Stokes

539.385

838. A PARTICULAR SOLUTION OF THE GENERAL EQUA-ONS IN CYLINDRICAL POLAR COORDINATES OF THE THEORY OF IDEAL PLASTICITY. D.D.Ivlev.
Dokl. Akad. Nauk SSSR, Vol. 123, No. 6, 988-90 (1958). In Russian.

Ideally plastic behaviour is specified in accordance with Mises in terms of a linear relation between the tensors of stress and rate of strain. A particular solution of the equations is obtained which determines the velocity of displacement. It is appropriate to a cylindrical body and corresponds to simultaneous torsion and extension in the presence of a gravitational force in direction of the axis and centrifugal force about the axis. R.Eisenschitz

539.4

12839. EFFECT OF SURFACE FILMS ON THE STRENGTH OF METAL WHISKERS. W.W.Webb and M.Stern.
J. appl. Phys., Vol. 30, No. 9, 1471 (Sept., 1959).

Copper and silver whiskers were prepared by hydrogen reduction of the metal halides, and exposed to the atmosphere until surface tarnish films were visible. Their elastic strengths were measured before and after electrochemical removal of the surface film. In every case the elastic strength was the same, within 30%, before and after cleaning. This suggests that the whiskers were completely free from dislocations, rather than that they contained dislocations immobilized by the surface layer. B.T.M.Willis

539.411

12840. SOME RESULTS OF TESTING NAPHTHALENE SINGLE CRYSTALS IN COMPRESSION.
Z.B.Perekalina, V.R.Regel' and G.A.Dubov.
Kristallografiya, Vol. 3, No. 1, 71-9 (1958). In Russian.

Crystals of different orientations were tested in compression and relaxation. The compression curves show jumps associated with the formation of faults. The flow limits varied from 15 to 360 g/mm^2. R.F.S.Hearmon

539.415

12841. DEPENDENCE OF CRITICAL SHEAR STRESS IN ZINC SINGLE CRYSTALS ON TEMPERATURE AND DEFORMATION VELOCITY. V.R.Regel' and V.G.Govorkov.
Kristallografiya, Vol. 3, No. 1, 64-70 (1958). In Russian.

Tensile tests were carried out on crystals of various orientations, between 20° and 416° C, and at deformation velocities of 2.3×10^{-1}, 7.4×10^{-4} and 3.3×10^{-5} mm/sec. Photographs of the specimens after test, together with the corresponding stress-strain curves are reproduced. The dependence of critical shear stress on temperature is shown graphically for the three deformation velocities; over the temperature range investigated, the critical stress falls in the ratio of about 5 : 1. R.F.S.Hearmon

539.434

12842. INFLUENCE OF NON-UNIFORM HEATING AND CREEP ON THE CHANGE OF STRESSED CONDITIONS. B.F.Shorr.
Dokl. Akad. Nauk SSSR, Vol. 123, No. 5, 809-12 (1958). In Russian.

The combination of high stress, appreciable mean temperature and great non-uniformity of temperature distribution leads to development of creep which extends in different directions with rapidly varying speeds. This in turn causes considerable redistribution of internal stress in time. The author investigates influence of temperature gradients on the speed of plastic deformation; the analysis is based on the recent work of Rabotnov (Izv. Akad. Nauk SSSR, Otdel tekh. Nauk, No. 5, 1957). He finds that the stress distribution generally tends, as $t \to \infty$, to an asymptotic value, which differs considerably from the initial one. J.K.Skwirzynski

539.61

12843. LAWS OF ADHESION. O.L.Anderson.
J. appl. Phys., Vol. 30, No. 4, 593-4 (April, 1959).

Bowden and Tabor's theory shows that friction between clean surfaces is due to adhesion between the asperities of the sliding surfaces. This letter is a preliminary report of work done to test this theory. In the tests two metal rods were pressed together along their axes and rotated until seizure occurred, the force required to separate the rods was then measured and the adhesion coefficient determined. The results show a high degree of scatter and a very large number of observations had to be taken to obtain a statistical result which does however support Bowden and Tabor's theory. The large number of observations were obtained for copper against copper while preliminary work on a large number of metals indicate the same trend. It is pertinent to note that Bowden and Tabor's work has demonstrated clearly the need for extreme cleanliness, and for working under high vacua. The present work was done under normal

atmospheric conditions, which probably accounts for the scatter the author observed. T.C.Toye

539.61 : 537.311.33

12844. THE ROLE OF THE SURFACE PROPERTIES OF A SEMICONDUCTOR IN ADHESION PHENOMENA.
V.P.Smilga and B.V.Deryagin.
Dokl. Akad. Nauk SSSR, Vol. 122, No. 6, 1049-52 (Oct. 21, 1958). In Russian.

An extension of previous work on adhesion at a semiconductor–metal interface (see Abstr. 1913 of 1959) to take into account the presence of surface states. When parameters in the equations derived are given reasonable values, adhesive forces of the order of tens of kg/cm^2 are obtained. C.H.L.Goodman

539.89

12845. TWO PRESSURE INDUCED PHASE TRANSITIONS IN TRIGLYCINE SULFATE. H.L.Suchan and H.G.Drickamer.
J. chem. Phys., Vol. 31, No. 3, 856 (Sept., 1959).

539.8

12846. COMPACT MULTI-ANVIL WEDGE-TYPE HIGH PRESSUR APPARATUS. E.C.Lloyd, U.O.Hutton and D.P.Johnson.
J. Res. Nat. Bur. Stand., Vol. 63C, No. 1, 59-64 (July-Sept., 1959).

Apparatus for generating high pressures by application of forc by an anvil against each face of a solid polyhedron is described. T equipment constructed utilized a tetrahedron of pyrophyllite and four tungsten carbide anvils as described earlier by Hall (Abstr. 4613 of 1958). External force is applied to only one of the anvils, and wedge reaction forces act on the other anvils, permitting the equipment to be used in a conventional hydraulic press. Examples of results of use of the equipment are given. Success of the design has been shown by the repeated generation of pressures in excess 100 000 atmospheres indicating that large existing presses might b used to generate pressures of this order in volumes of several cubic inches. For higher pressures a two-stage multi-anvil appar tus is proposed in which the second-stage anvils are embedded in a large pyrophyllite tetrahedron to obtain necessary supporting force

PHYSICAL CHEMISTRY

PHASE EQUILIBRIUM
CHEMICAL REACTIONS

541.124

12847. EFFECT OF THE INTENSITY OF RADIOACTIVE EMISSION OF S^{35} ON THE RATE OF THE ISOTOPIC EXCHANGE OF SULPHUR IN THE SYSTEM $K_2S^*O_4$–SO_3.
V.I.Spitsyn and I.E.Mikhailenko.
Dokl. Akad. Nauk SSSR, Vol. 121, No. 2, 319-21 (1958). In Russian.

It was found that, while the rate of isotopic exchange is about 12% when the specific radioactivity of K_2SO_4 is 0.02-0.03 mg/g, it rises to 26.7% at 0.35 mg/g, reaching a maximum of 66.9% at 2.3 mg/g, after which the rate drops (33-37% at 8-16 mg/g). F.Lachman

541.124 : 533.7

VELOCITY DISTRIBUTION IN A CHEMICALLY REACTING GAS. See Abstr. 11914

541.126

12848. REACTION OF HYDROGEN ATOMS WITH SOLID OXYGEN AT 20°K. R.Klein and M.D.Scheer.
J. chem. Phys., Vol. 31, No. 1, 278-9 (July, 1959).

Reaction of hydrogen atoms has been detected with oxygen solidified on the internal surface of a reaction vessel at 20°K. The only possible reaction is $H + O_2 \rightarrow HO_2$, which must have an activation energy of less than 1 kcal/mole, since it occurs at 20°K. The extent of hydrogen pick-up suggests diffusion of hydrogen atoms in the solid. R.C.Murray

541.126

12849. SOME CRITERIA FOR THE IN SITU COMBUSTION OF CRUDE OIL. P.Cooperman.
J. appl. Phys., Vol. 30, No. 9, 1376-80 (Sept., 1959).

Presents a steady-state theory for the in situ combustion of oil in an underground reservoir. The hydrodynamic, chemical, and thermal aspects are treated in their relation to each other. The major results are three criteria for successful forward burning. These criteria state the minimum values for the oil saturation, the carbon-hydrogen ratio, and the volume flow rate.

541.126 : 534.222.2

SIMULTANEOUS DETONATION ALONG A LINE. See Abstr. 11936

541.126 : 537.523.3

THE IGNITION OF PROPANE–AIR MIXTURES IN BRUSH DISCHARGES. See Abstr. 12320

541.127

12850. KINETICS OF COORDINATE BOND FORMATION. III. METHOD OF TEMPERATURE PATTERNS AND THE REACTION $NH_3 + BF_3$. F.T.Smith and G.B.Kistiakowsky.
J. chem. Phys., Vol. 31, No. 3, 621-32 (Sept., 1959).

For Pt II, see Abstr. 5010 (1955). The method of determining rate constants from the temperature pattern in dilute spherical diffusion flames is critically examined, and several possible sourc of error are corrected for. The method is tested by a re-examination of the reaction $NH_3 + BF_3$ over a wide range of experimental parameters. On the whole, previous results are confirmed, but th high-pressure limiting rate is found to be 1.2×10^{11} cm^3/mole sec somewhat less than half the former value, and some new quantities can be measured. Ammonia is found to be about three times as effective as nitrogen, in energy-exchange collisions with the excite product of the initial addition reaction. In the absence of N_2, the r constant is half the high-pressure limit when the NH_3 concentratio is about 8×10^{-8} mole/cm^3. The heat of the gas-phase addition re action is 27.5 ± 2 kcal/mole and the equilibrium constant for the reverse reaction is $\ll 2 \times 10^{-10}$ mole/cm^3. The activation energy, if any, is less than 3 kcal/mole.

541.1

12851. CAPACITY OF THE ELECTRICAL DOUBLE LAYER AN ADSORPTION AT POLARIZED PLATINUM ELECTRODES. I. ADSORPTION OF ANIONS. P.V.Popat and N.Hackerman.
J. phys. Chem., Vol. 62, No. 10, 1198-203 (Oct., 1958).

The differential capacity of the electrical double layer at pola ized platinum electrodes was investigated as a function of the type and concentration of anions. The method of charging curves, utili ing a square-wave signal was employed. The "hump" in the potential-capacity curve is characteristic of the anion involved and explained in terms of adsorption or desorption of the anion. The tenacity of adsorption is found to increase with the covalent charac ter of the adsorbed anions as NO_3^- and $F^- < SO_4^{--} < Cl^- < Br^- <$ Evidence is presented to indicate that the adsorbed iodide, bromid and chloride ions are dehydrated before their anodic discharge. Fluoride and nitrate ions do not appear to be dehydrated even on the anodic side of the zero point of charge. A similarity is established between polarized platinum and mercury electrodes and the location of the zero point of charge for platinum is indicated. It is observed that hydrogen over-voltage on platinum is a function of th type of anions present.

ELECTROCHEMISTRY

541.13

12852. FREE ENERGY OF STRONG ELECTROLYTES.
A.A.Vedenov.
Zh. eksper. teor. Fiz., Vol. 36, No. 3, 942-3 (March, 1959). In Russian.

The author develops a formula for calculating the free energ per volume unit of a strong electrolyte, as a function of the follow magnitudes: free energy of an ideal gas; Debye radius; density an charge of the particles in question; temperature. The derivation i

ed on the author's technique (graphical) for calculating the cor- ation pair function in classical statistical physics.

F.Lachman

541.135.5 : 536.7

ELECTROCHEMICAL STUDY OF Cu–Pd ALLOYS. Abstr. 12197

PHOTOCHEMISTRY
RADIATION CHEMISTRY

541.141 : 535.37

PHOTOLYSIS OF ACETONE AND ACETONE–BIACETYL XTURES. See Abstr. 12112

ISPERSIONS . COLLOIDS . ADSORPTION

541.18.047.5

53. DYNAMICAL THEORY OF ELECTROSEDIMENTATION. Peterlin and M.Ribarič.
chem. Phys., Vol. 31. No. 3, 759-67 (Sept., 1959).

Besides the steady-state solution the time dependence of particle tribution in the cylindrical cell in both limiting cases, $t \to 0$ and $t \to \infty$, is given. The initial rise of electric capacity and the asymptic approach to the steady state yield information concerning the fusion constant of the suspended particles (weight average and mber average). The dependence of the capacity change on the plied field permits, at least in principle, the determination of rticle size averages of increasing order. The experimental arrangment can be greatly improved by using suspension liquids having her dielectric constant than the particles, e.g., polar liquids and npolar particles. The field then drives the particles away from the ntral wire into areas of lower field strength. In such a case the ncentration in no part of the cell noticeably surpasses the initial ncentration and it is therefore much easier to remain in the linear ncentration range. A rough estimate indicates that the method may promising for suspensions of compact particles of $M \sim 10^6$ where ather simple measurement yields the average size. With true lutions of linear macromolecules the situation is much less favourle because the large extension of the coil requires so much lower ncentrations.

541.182 : 534.39

ROLE OF TURBULENCE IN THE ACOUSTIC COAGULATION F AEROSOLS. See Abstr. 11960

541.182.4 : 535.39

854. DETERMINATION OF SURFACE-AVERAGE PARTICLE AMETER OF COLORED EMULSIONS BY REFLECTANCE, AND PLICATION TO EMULSION STABILITY STUDIES. N.E.Lloyd. Colloid Sci., Vol. 14, No. 4, 441-51 (Aug., 1959).

The relationship between the reflectances of coloured emulsions l-in-water) and the surface-average diameter of their dispersed ases was investigated. The dispersed oil phases of the emulsions ntained a red azo dye (1-xylyl, azo-2-naphthol) so that reflectance 450 mμ was a function of both scattering and absorption by the ulsions. Reflectances at wavelengths at which the coloured inter- l phase partially absorbed the incident light were found to be in- rsely proportional to the surface-average particle diameter raised some power, k. The relationship between reflectance and surface- erage particle diameter was independent of particle size distribu- n. Examples are given to show the applicability of the technique evaluation of different emulsion stabilizers and to studies of the netics of emulsion coalescence. Some of the emulsions studied splayed limited coalescence. The mode of coalescence up to the int of limiting particle size followed first-order kinetics in which e rate of decrease in specific interfacial area at any given time was oportional to the specific interfacial area at that time.

541.182.6

855. THE INTERACTION BETWEEN TWO CYLINDER SHAPED OLLOIDAL PARTICLES. M.J.Sparnaay.
ecueil Trav. chim. Pays-Bas, Vol. 78, No. 8, 608-709 (Aug., 1959).

The theory of the stability of lyophobic colloids, as given by Derjaguin (1941) and by Verwey and Overbeek (1948) for the flat-plate or sphere model of colloidal particles, is applied to cylindrical colloidal particles. Anisometry was taken into account by considering the interaction between two parallel particles and between two particles in a crossed position. Mathematical expressions are given for the repulsive and the attractive potential energy in these two cases. It is inferred from these expressions that the behaviour of two parallel cylinders is intermediate between the behaviour of two flat plates and two spheres, whereas two crossed cylinders behave in much the same way as two spheres.

541.183 : 539.19

HINDERED ROTATOR MODEL FOR ADSORBED HYDROGEN AT LOW TEMPERATURES. See Abstr. 12741

CHEMICAL ANALYSIS

544.64

12856. USE OF THE EM-3 ELECTRON MICROSCOPE FOR X-RAY SPECTRAL MICROANALYSIS. V.N.Vertsner and A.M.Solov'ev. Optika i Spektrosk., Vol. 5, No. 1, 83-5 (1958). In Russian. English summary: PB 141047T-6, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Metallurgical specimens for test are mounted on the stage of an electron microscope. X-rays emitted from the portion (1-2μ diameter) in the electron beam pass through a window to a bent crystal spectrograph and geiger counter and pen recorder. The composition of the separate phases of 2 phase alloys of Co containing Cr, W, Ni etc. was determined. G.F.Lothian

545.71

12857. ON THE POSSIBILITY OF PRODUCING A GAS ANALYSER BASED ON THE NEGATIVE OPTICO-ACOUSTIC EFFECT WITHOUT USING A LOW-TEMPERATURE REFRIGERATOR. P.I.Bresler. Optika i Spektrosk., Vol. 5, No. 2, 220-2 (1958). In Russian. English summary: PB 141047T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

A chamber containing the gas was maintained 10^0 C above ambient temperature and allowed to radiate through a rock-salt window to an i.r. absorber through a chopper disk. The intermittent heat losses caused pressure pulsations which were picked up by a microphone in the chamber and amplified. Calibration curves of signals for different gases were obtained. The system has high selectivity for aliphatic hydrocarbons due to the long wavelength of the i.r. radiation. W.T.Welford

545.82

12858. ON THE METHOD OF QUANTITATIVE GAS ANALYSIS USING ELECTRON-VIBRATIONAL SPECTRA OF DIATOMIC MOLECULES. L.V.Leskov.
Optika i Spektrosk., Vol. 4, No. 2, 168-79 (Feb., 1958). In Russian. English summary: PB 141047T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

A relation is derived between the intensity of a given electron-vibrational spectral line of a diatomic molecule, the temperature and the concentration of radiating particles assuming (1) that the distribution of the molecules in electron states and in vibrational levels is of a Boltzmann type with respective temperatures which are constant in the region considered and (2) that reabsorption is not important. The conditions under which the relation holds are discussed and the relation is applied to the Angstrom and Hertzberg systems of CO, the green system of AlO, and the second infrared system of CaO. R.D.Hudson

545.827

12859. PHOTON ACTIVATION MEASURES OXYGEN, CARBON IN BERYLLIUM. D.B.Beard, R.G.Johnson and W.G.Bradshaw. Nucleonics, Vol. 17, No. 7, 90-4, 96 (July, 1959).

The Be sample is irradiated in a bremstrahlung beam produced by a 1 mm lead radiator in a 0.15 μa 40 MeV electron beam from a linear accelerator. Annihilation photons from the positron activity of O^{15} and C^{11} are counted using two 4 inch NaI crystals in a coincidence circuit. The C and O activities are identified by their half-lives. The maximum sensitivity is ≅ 1 ppm for both O and C. R.D.Smith

CRYSTALLOGRAPHY

548.2

12860. THE STRUCTURE OF THE SUPERFICIAL LAYER ON THE (100) PLANE OF IRON. THE DENDRITIC STRUCTURE. L.Špaček.
Czech. J. Phys., Vol. 8, No. 4, 411-15 (1958). In German.

The relation between the dimensions of the surface pattern and the direction of the observed surface is worked out from energy considerations. A.R.Stokes

548.5

12861. ON THE PRODUCTION OF SINGLE CRYSTALS OF THE LOW MELTING-POINT METALS. V.A.Labzin and V.V.Bazhenov.
Fiz. Metallov. i Metallovedenie, Vol. 6, No. 5, 941-2 (1958). In Russian.

A simple modification of a zone-melting apparatus is described. By its use, Zn, Cd and Mg crystals can be grown with fairly close control of orientation. A.F.Brown

548.5

12862. (110) [001] COMPONENT PRIOR TO SECONDARY RECRYSTALLIZATION IN THREE PERCENT SILICON IRON. C.G.Dunn.
J. appl. Phys., Vol. 29, No. 11, 1608-9 (Nov., 1958).

Fiedler (Abstr. 9177 of 1958) suggested that Nielson's theory [Transactions of the American Institute of Mining (and Metallurgical Engineers), Vol. 200, 1084 (1954)] can explain why a (110) [001] component of strength about twice random in the primary recrystallization texture helps to develop a strong (110) [001] secondary texture. It is shown that using this theory calculations of the expected amount of the component in the primary texture from the reported torque data suggest serious disagreement between the magnetic and X-ray data. A nearly random texture is also unsatisfactory. S.Weintroub

548.5

12863. CHANGE OF FORM OF LIQUID INCLUSIONS [IN CRYSTALS] ON CHANGE OF TEMPERATURE. M.O.Kliya and G.G.Lemmlein.
Kristallografiya, Vol. 3, No. 2, 206-8 (1958). In Russian.

A microkinematographic method is applied to study the behaviour of liquid inclusions in saltpetre crystals on rapid change of temperature. R.F.S.Hearmon

548.5

12864. CAPTURE OF DROPS OF EMULSION BY A GROWING CRYSTAL ON CRYSTALLIZING FROM SOLUTION.
M.O.Kliya and I.G.Sokolova.
Kristallografiya, Vol. 3, No. 2, 219-24 (1958). In Russian.

Using a microkinematographic technique, the formation of inclusions is studied in crystals of $Na_2B_4O_7$ and $Na(NH_4)HPO_4$ growing from a solution containing petroleum emulsion. A linear relation is found between the length/thickness ratio of the inclusions and the velocity of boundary growth. R.F.S Hearmon

548.5

12865. INVESTIGATION OF THE PROCESS OF CRYSTALLIZATION OF BARIUM TITANATE FROM BARIUM CHLORIDE MELTS.
V.A.Timofeeva and I.A.Pleteneva.
Kristallografiya, Vol. 3, No. 2, 214-18 (1958). In Russian.

The crystallization process was investigated between 1200° and 1470° C by the method of differential thermal analysis. The constitution diagram of the system $BaCl_2$–$BaTiO_3$ was established. $BaTiO_3$ was obtained in the form of triangular and square plates up to 1 cm^2 in size. R.F.S.Hearmon

548.5

12866. KINETIC STUDIES ON ZINC FERRITE FORMATION.
T.Yamaguchi and T.Takei.
Sci. Pap. Inst. Phys. Chem. Res. (Tokyo), Vol. 53, 51-65 (June, 1959).

Growth rate and structure of the diffusion-layer obtained by heating a Fe_2O_3-imbedded ZnO disk at temperatures from 1100° to 1370° C are examined. The layer thickness increases linearly with time initially, then parabolically. Temperature dependence of growth rate in the parabolic part is characterized by an apparent activation energy of 95.5 kcal/mol. On the basis of results of marker experiments and microscopic examination of the layer, the mechanism of the diffusion process is discussed. It is established that the phase relationship between the reactants and reaction product does play an important role in the growth of the diffusion layer. Effect of additions to the Fe_2O_3 body on the layer growth is also studied.

548

12867. SURFACE PRESSURE IN CRYSTALS. A.A.Chernov.
Kristallografiya, Vol. 3, No. 2, 227-9 (1958). In Russian.

The condition of isotropy of surface pressure leads to the san equilibrium form for a crystal as the condition of minimum surfac energy. The conversion of an arbitrary crystal into the equilibriu form is determined by the anisotropy of the surface pressure. R.F.S.Hearmo

548

12868. HIGH-TEMPERATURE OXIDATION OF IRON WHISKERS.
J.V.Laukonis and R.V.Coleman.
J. appl. Phys., Vol. 30, No. 9, 1364-8 (Sept., 1959).

Single crystal α-iron whiskers have been used to study early stages in the oxidation of iron at high temperatures. Well-defined oxide patterns are observed on clean iron surfaces and there are characteristic differences between the patterns on {100} and {110} faces. These differences tend to be eliminated if a natural oxide film is present before the high temperature oxidation is performe Unusual mosaic oxide patterns which form on clean {100} iron surfaces are shown.

X-RAY CRYSTALLOGRAPHY

548.73/.

X-RAY AND ELECTRON INVESTIGATION OF MATERIALS.
See also the Section entitled "STRUCTURE OF SOLIDS".

548.7

12869. A NEW AID FOR THE RAPID DETERMINATION OF ABSORPTION CORRECTIONS BY ALBRECHT'S METHOD.
D.K.Smith.
Acta cryst., Vol. 12, Pt 6, 479-80 (June, 1959).

Values for $\exp(-\mu x)$ are read off a suitably calibrated scale fo path lengths x within the crystal; it is then only necessary to aver them on a computer. A.R.Stok

548.734

12870. APPLICATION OF THE FINE-FOCUS X-RAY TUBE FOR THE INVESTIGATION OF THE SIZE AND ORIENTATION AND RELATIVE POSITION OF THE BLOCKS OF MOSAIC IN MONO-CRYSTALS. J.Auleytner.
Acta phys. Polon., Vol. 18, No. 1, 81-3 (1959).

A diffraction photograph is taken with a crystal moving in a very fine X-ray beam and the film moving synchronously. Crystal lite sizes of 50 μ and angular twists of 30" can be measured. A.R.Stok

548.7

12871. ON THE QUESTION OF THE INVESTIGATION OF THE FINE STRUCTURE IN THE INTENSITIES OF DIFFRACTION LINES — PURE METALS. L.V.Tikhonov.
Dokl. Akad. Nauk SSSR, Vol. 122, No. 3, 389-92 (1958). In Russian

Formulae developed by Wilchinsky (Abstr. 2169 of 1951) and Kochanovská (Abstr. 7029 of 1954) are applied to the calculation of the integrated intensities of reflections from a semi-infinite speci men. A.L.Mack

548.7

12872. SCALING ERRORS IN RADIAL DISTRIBUTION STUDIES.
A.Bienenstock.
J. chem. Phys., Vol. 31, No. 2, 570 (Aug., 1959).

It is shown that an error in the scaling factor will give rise t spurious peaks at short inter-atomic distances. Errors in the absorption correction are unlikely to be important. A.R.Stok

548.7

12873. DESIGN OF A STRUCTURE FACTOR COMPUTER FOR X-RAY CRYSTAL STRUCTURE ANALYSIS. P.V.Venkatakrishna
J. sci. industr. Res., Vol. 17B, No. 9, 339-45 (Sept., 1958).

Cosine and sine functions are generated by selsyns (variable

tio transformers) and temperature-factor corrections, etc., by m-operated potentiometers. Telephone uni-selectors are used c coordinate positioning. The speed of operation is one structure tor per ~ 3 sec. A.R.Stokes

548.735.4

874. ON AN ANALYTIC APPROXIMATION TO THE ATOMIC CATTERING FACTOR. J.B.Forsyth and M.Wells.
ta cryst., Vol. 12, Pt 5, 412-15 (June, 1959).

The method of Vand et al.(Abstr. 7633 of 1959) is used, with me modifications, to fit scattering factors to a sum of two Gauss- n error terms and a constant. The constants of these functions e tabulated for 106 atoms and ions, including 12 ions for which w calculations of scattering factors have been made.

A.R.Stokes

548.735.4

875. GRAPHICAL METHOD OF SOLVING THE BASIC HARKER-ASPER INEQUALITIES. S.V.Borisov, P.V.Pavlov and N.V.Belov.
ristallografiya, Vol. 3, No. 1, 90-2 (1958). In Russian.

Two network graphs are given for solving the inequalities bstr. 3015 of 1948). R.F.S.Hearmon

548.736.1

876. THE DISTRIBUTION OF AN IMPURITY IN A MONO-RYSTAL OF METALLIC ZINC HAVING A HONEYCOMB SUB-RUCTURE. M.Valoukh and I.B.Borovskii.
kl. Akad. Nauk SSSR, Vol. 123, No. 3, 490-1 (1958). In Russian.

Single crystals of zinc were prepared by Chokral'skii's ethod with 0.7% copper. The crystals were withdrawn from the elt at 10 mm/min with a temperature gradient of about 20 deg C/cm. ctions were cut perpendicular to the axes. Chemical polishing owed up a honeycomb structure. These sections were examined th Borovskii's micro-X-ray-spectroanalyser and showed a con-ntration of 0.7% Cu in the middle of the cells and 0.4% at the ndaries. The cells were about 60 μ across. A.L.Mackay

548.736.1

877. ON THE OCCURRENCE OF FIVEFOLD ROTATIONAL YMMETRY IN METAL WHISKERS. A.J.Melmed and D.O.Hayward.
chem. Phys., Vol. 31, No. 2, 545-6 (Aug., 1959).

Vapour grown metal whiskers produced under relatively poor acuum can show a five-fold rotational symmetry in the field emission roblem. This effect has been observed in Ni, Fe and Pt on W sub-rates and also with Fe on Fe and Pt on Aquadag. For whisker rowth times of a few minutes fivefold whiskers predominate at $^{-6}$ min and normal whiskers at 10^{-8} min. A proposed model with vefold symmetry about a central [110] axis in a f.c.c. structure is nown. It is suggested that surface energy effects are important and at gas adsorption could be responsible for the fivefold structure.

W.Bardsley

548.736.1

878. X-RAY MEASUREMENT OF THE ATOMIC SCATTERING ACTOR OF IRON. B.W.Batterman.
hys. Rev., Vol. 115, No. 1, 81-6 (July 1, 1959).

The X-ray integrated intensities of Bragg reflections of iron, opper, and NaCl powders were measured with monochromatic e K_α radiation. By investigating the effect of cold work on intens-ies of the metal powders and comparing the measured intensities f different orders with theoretical values, it was shown that extinc-on, surface roughness, and preferred orientation effects were egligible. The four measured iron reflections gave atomic scatter-ng factors relative to either copper or NaCl which agreed, within xperimental error, with values calculated from wave-functions of ne isolated iron atom. It is estimated that the experimental form actor for the lowest order reflection of copper and iron agrees with ree-atom values to an error corresponding to the contribution of one free-atom-3d electron. This is to be contrasted with results f Weiss and DeMarco (Abstr. 3583 of 1958), who concluded from ingle-crystal measurements that metallic iron has (2.3 ± 0.3) 3d lectrons, compared with 6 for the free atom.

548.736.3 : 539.19

2879. MOLECULAR AND CRYSTAL STRUCTURE OF B_8Cl_8. . PRELIMINARY X-RAY DIFFRACTION STUDY.
M.Atoji and W.N.Lipscomb.
. chem. Phys., Vol. 31, No. 3, 601-4 (Sept., 1959).

Unit cell dimensions and space groups of two modifications of B_8Cl_8 are described. The density measurements indicate that the ormula hitherto represented as $(BCl_{0.9})_x$ is in best agreement with B_8Cl_8. Complete three-dimensional X-ray diffraction data of one of the modifications have been taken. The unit cell of this form is orthorhombic, of symmetry $P2_12_12_1$ and four B_8Cl_8 molecules in a unit cell of dimensions a = 13.64, b = 7.85, and c = 12.91 A.

548.736.3 : 539.19

12880. MOLECULAR AND CRYSTAL STRUCTURE OF B_8Cl_8. II. SOLUTION OF THE THREE-DIMENSIONAL STRUCTURE.
R.A.Jacobson and W.N.Lipscomb.
J. chem. Phys., Vol. 31, No. 3, 605-9 (Sept., 1959).

With only the information that B and Cl are present in the approximate ratio of 10 to 9, the molecular structure of B_8Cl_8, a new boron chloride, has been determined from single crystals by X-ray diffraction methods. The chlorine positions, solved by a point-by-point, three-dimensional Patterson superposition method, enabled the boron atoms to be located from electron density maps. The boron atoms form a dodecahedron with triangular faces and D_{2d} symmetry. One chlorine atom is attached to each boron atom at an average distance of 1.70 A. The shortest boron—boron distance is 1.78 A. The overall agreement factor is

$$R = \frac{\Sigma||F_o| - |F_c||}{\Sigma|F_o|} = 0.17.$$

548.736.5 : 539.32

LATTICE CONSTANTS OF 20 ALUMS. See Abstr. 12830

548.736.6 : 536.413.2

12881. EXPERIMENTAL INVESTIGATION OF THE INTERPLANAR DISTANCE d_{001} ON HEATING CRYSTALS OF PHLOGOPITE AND MUSCOVITE. M.S.Metsik and R.A.Zhidikhanov.
Kristallografiya, Vol. 3, No. 1, 95-8 (1958). In Russian.

The distance was measured by an X-ray method at different temperatures, and the results expressed as a linear expansion coefficient. The effect of various heat treatments and immersion in water was also measured. R.F.S.Hearmon

548.737 : 532.783

DIFFRACTION OF X-RAYS BY A LIQUID MONOCRYSTAL OF THE NEMATIC TYPE. See Abstr. 11907

548.737 : 539.19

STRUCTURE OF $B_{10}H_{12}(CH_3CN)_2$. See Abstr. 12756

548.737 : 539.32

LATTICE CONSTANTS OF THE GUANIDINE ALUMINIUM SULPHATE HEXAHYDRATE GROUP. See Abstr. 12829

548.74

12882. ELECTRON DIFFRACTION DETERMINATION OF THE STRUCTURE OF Tl_2Se. M.M.Stasova and B.K.Vainshtein.
Kristallografiya, Vol. 3, No. 2, 141-7 (1958). In Russian.

The cell of Tl_2Se is tetragonal with dimensions a = 8.52, c = 12.68 kX; the space group is C_{4h}^3—P4/n with 10 molecules of Tl_2Se per cell. The structure consists of hollow tetrahedra of Tl, connected by layers of Se atoms. R.F.S.Hearmon

548.74 : 538.2

12883. NEUTRON DIFFRACTION TECHNIQUES AND THEIR APPLICATIONS TO SOME PROBLEMS IN PHYSICS.
S.S.Sidhu, LeR.Heaton and M.H.Mueller.
J. appl. Phys., Vol. 30, No. 9, 1323-40 (Sept., 1959).

Neutron transmission and diffraction techniques are described with application to problems in nuclear physics, crystallography, magnetic scattering, physical structure of materials, and the liquid state. Experimental results for nuclear scattering amplitudes, positions of light atoms among heavy atoms, magnetic moment alignments in antiferromagnetic structures, and diffraction of neutrons by alkali metals in the liquid state are reported. The main features of the design and operation of the neutron diffraction spectrometer and the auxiliary equipment are given.

548.74

12884. NEUTRON DIFFRACTION STUDY OF DEFECT STRUCTURE IN SINGLE CRYSTALS OF METALS.
B.G.Lyashchenko, D.F.Litvin, I.M.Puzei, Yu.G.Abov and V.S.Golovkin.
Kristallografiya, Vol. 3, No. 2, 148-54 (1958). In Russian.

A short survey of neutron diffraction work on mosaic crystals is followed by a description of effects observed in Ni—Fe and Ni—Fe—Mo—Cu crystals grown from the melt. The experimental arrangement was similar to that described by Lowde (Abstr. 3947 of 1951). Multiple and nonsymmetrical peaks were obtained from some of the alloy crystals. J.Adam

GEOPHYSICS

550.312

12885. GRAPHICAL METHOD OF CALCULATING THE SECOND VERTICAL DERIVATIVE OF THE GRAVITATIONAL POTENTIAL. L.V.Dimitrov.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 23, No. 4, 617-20 (1959). In Russian.

Describes a method of calculating the effect of gravitational anomalies at the earth's surface. J.M.Hough

550.34

12886. FIRST MOTION METHODS IN THEORETICAL SEISMOLOGY. L.Knopoff and F.Gilbert.
J. Acoust. Soc. Amer., Vol. 31, No. 9, 1161-8 (Sept., 1959).

Techniques are presented for approximating integral solutions to some problems in theoretical seismology. The approximations obtained are the first terms of asymptotic series in powers of $t-t_0$, where t is the time and t_0 is an arrival time. The approximations are obtained by evaluating the integral form of the Laplace transform of the time solution by the saddle point method or a variation of it. To the resulting expression is applied a Tauberian limit theorem from which is obtained the time solution. Two examples are given which illustrate some of the specific techniques for the use of the method.

550.384 : 621.317.42

12887. FLUXGATE RECORDING OF THE TRANSIENT VARIATIONS IN THE GEOMAGNETIC FIELD AT JODRELL BANK (GEOMAGNETIC LATITUDE 56.0°N). C.D.Watkins.
Jodrell Bank Ann., Vol. 1, No. 5, 223-31 (March, 1958).

Measurements of the earth's magnetic field have been made at Jodrell Bank since November 1950 using instruments of the fluxgate (saturable core) magnetometer type. The paper describes the construction and operation of such an instrument and refers to some of its applications.

550.385

12888. POSSIBLE AURORAL ORIGIN OF CERTAIN GEOMAGNETIC DISTURBANCES. J.Coulomb.
Ann. Geophys., Vol. 13, No. 2, 91-102 (1957). In French.

There is an a priori possibility for oscillatory disturbances to be generated during polar aurorae and to be propagated from the polar zones to lower latitudes. A propagation theory, rather incomplete mathematically, gives correct orders of magnitude for "giant disturbances". But for the "disturbance trains" often associated with geomagnetic bays, the results contradict experimental observations.

550.385 : 523.75

12889. GEOMAGNETIC ACTIVITY AND [SOLAR] ERUPTIONS. P.Simon.
Ann. Geophys., Vol. 12, No. 3, 167-82 (1956). In French.

There is a statistical relationship between the most important noisy flares, occurring either in the inner or the outer parts of the solar disk, and a rise of the geomagnetic activity. There is no such relationship for quiet flares. This rise of activity is different from the sudden commencement activity related to the passage of the noisy sunspots at the central solar meridian.

550.93

12890. THE POTASSIUM–ARGON-AGE OF SOME TECTITES. W.Gentner and J.Zähringer.
Z. Naturforsch., Vol. 14a, No. 7, 686-7 (July, 1959). In German.

With a sensitive mass-spectrometer and by liberating the gas in an ultrahigh vacuum at 1600°C the age of moldavite was assessed to 8.5×10^8 years. These antediluvial moldavites do not contain Al^{26} whose half-life is 7.5×10^5 years, but Be^{10} with a half-life of 2.7×10^6 years. The Be^{10} activity is however three times smaller than in australites whose K–A age is 0.58×10^8 years. These australites still have an Al^{26} activity. R.Schnurmann

ATMOSPHERE . IONOSPHERE

551.50

12891. USE OF AN ECONOMICAL THERMAL TRANSDUCER AS A NET RADIOMETER. L.J.Fritschen and W.B.van Wijk.
Bull. Amer. Meteorol. Soc., Vol. 40, No. 6, 291-4 (June, 1959).

A small inexpensive all-weather instrument is described, a number of which can be joined to a single-pen recorder by automatic switching to cover a network of observing locations. The radiometer is sensitive to the more important solar and terrestri wavelengths, and it is unaffected by precipitation. D.R.Bart

551.51(

12892. THE AERONOMIC PROBLEM OF HELIUM. M.Nicolet.
Ann. Geophys., Vol. 13, No. 1, 1-21 (1957).

The escape of helium from the terrestrial atmosphere has been investigated, taking account of the simultaneous presence of He^4 and He^3 in the atmosphere. The generation mechanisms for H and He^3 are, respectively, the radioactivity of the earth's crust ($\leq 1.7 \times 10^6$ He^4 atoms cm^{-2} sec^{-1}) and the presence of cosmic ra tion (≤ 2 He^3 atoms cm^{-2} sec^{-1}) and lead to a unique escape time the order of 2 million years. If the temperature of the thermopau (2500° to 3000°K) is such that there is an escape of He^4, this caus the complete escape of He^3 from the thermospheric region in whic diffusion takes place. The process limiting escape is associated with the action of mixing in the region below the thermosphere. Under these conditions the atomic flow is proportional to the resp ive concentrations of He^4 and He^3. Thus, the ratio ($\sim 10^8$) of the rates of escape of He^4 and He^3 equals the ratio of the production r and is consequently equal to the ratio of the concentrations observ in the troposphere. From this it is concluded that the temperatur the thermopause must be variable and very high during short peri of time associated directly or indirectly with the solar activity.

551.51

12893. ATOMIC NITROGEN PRODUCTION BY ION–ATOM INTERCHANGE REACTIONS IN THE UPPER ATMOSPHERE. M.Hertzberg.
J. geophys. Res., Vol. 63, No. 4, 856-9 (Dec., 1958).

Preliminary night-time rocket measurements of the relative concentrations of the ions O^+/O_2^+ in the upper atmosphere indicat much higher concentrations than those computed from the rate-constants of possible ion–atom collisional reactions. The resul can be accounted for by assuming a ten-fold increase in the ratio N/N_2. It is concluded that the rate of production of N by the ion–atom interchange reaction $O^+ + N_2 \rightarrow NO^+ + N$ is at least a thousa times more rapid than that by dissociative recombination of N_2^+. G.M.Bro

551.51

12894. COMPARISON OF THE CHEMICAL AND SPECTROGRAPHIC METHODS OF ANALYSIS OF [ATMOSPHERIC] OZONE NEAR THE GROUND. S.I.Rasool and A.Vassy.
Ann. Geophys., Vol. 12, No. 4, 239-44 (1956). In French.

Simultaneous measurements of the ozone concentration were made by chemical and spectrographic methods and most of the results obtained compare favourably. However, in a few cases, the values obtained by the chemical method are much lower than those found spectroscopically. An analysis of the meteorological conditions existing during these measurements showed that the wind speed was zero or less than 3 knots. In the chemical metho the air is pumped in from a definite point, and, after being depriv of its ozone, is discharged, thereby making in calm weather the air around the station deficient in ozone. This clearly renders th chemical method unreliable.

551.510

12895. ANNOTATED BIBLIOGRAPHY ON OZONE IN THE ATMOSPHERE (1858–1953). M.L.Rice and G.Thuronyi.
Meteorol. Abstr., Vol. 10, No. 5, 759-94 (May, 1959).

One-hundred and sixty-two items, covering, inter alia, all aspects of analysis and instrumentation, factors affecting ozone distribution and concentration, effects of ozone, and collections of experimental data. Several comprehensive works are cited.

551.510.5 : 536.3

96. INFERENCE OF ATMOSPHERIC STRUCTURE FROM MOTE RADIATION MEASUREMENTS. L.D.Kaplan.
pt. Soc. Amer., Vol. 49, No. 10, 1004-7 (Oct., 1959).

A detailed analysis of the structure of the atmosphere, including e-dimensional distribution of temperature and water vapour, can btained from the spectral variation of its thermal radiation as ed from a reconnaissance aircraft or earth satellite. In order the measurements be capable of unambiguous interpretation, ever, it is essential that the selection of spectral intervals to be d are based on a carefully planned interpretation scheme. A sible programme is outlined, in which the temperature distribu- is obtained by measurements in the 15-μ CO_2 band and the water our distribution obtained by simultaneous measurements in the ational band. The temperature-and-pressure dependence of the orption coefficients must be taken into account. The instrument uld be a multiple-slit or multiple-detector grating spectrometer, able of resolving 10 cm^{-1} at 15 μ. Spectral models and methods nalysis of the spectra are discussed briefly.

551.510.535

RADIO-WAVE PROPAGATION IN THE IONOSPHERE. See also Section entitled "ELECTROMAGNETIC WAVES AND OSCILLA-ONS".

551.510.536

97. THE STUDY OF THE TERRESTRIAL EXOSPHERE.
.Paetzold.
ngew. Phys., Vol. 11, No. 6, 234-45 (June, 1959). In German.

A review article describing some of the phenomena associated h the uppermost regions of the ionosphere, the exosphere, where particle mean free path becomes of the same order as the vert- l layer separation. The observation and properties of whistlers treated in some detail and the nature of the information so far ained from artificial satellites and rocket research discussed.

S.J.St-Lorant

551.521 : 77

98. ON THE IRRADIATION ON INCLINED SURFACES AS LATED TO PHOTOGRAPHIC AND TECHNOLOGICAL EXPOSURE OBLEMS. M.R.Nagel.
tik, Vol. 15, No. 4, 193-218 (April, 1958).

The illumination conditions on a fixed surface facing south and lined 45° against the horizon under a clear sky, are computed for entire year and for geographical latitudes between 0° and 70°. nlight, skylight and light reflected from the ground are considered. e illumination on the inclined surface is then compared with that a horizontal one. From the computations the ratios of the total adiations on the two surfaces are derived for the day and the year d compiled in charts from which the ratio can be taken for every ation between 0° and 70° latitude and for every day of the year. nclusions are drawn from these computations with respect to a ries of sensitometric and technological exposure problems. eoretical and actual irradiation ratios for the Arctic region ree fairly well.

551.521.14 : 523.4

99. DIFFUSE REFLECTION FROM PLANETARY ATMOS-ERES. D.L.Harris.
trophys. J., Vol. 126, No. 2, 408-12 (Sept., 1957).

The H-functions for isotropic scattering have been determined values of the albedo, $\varpi_0 = 0.975$, (0.005), 1.000. These may also valuable in the study of absorption lines in stellar atmospheres. addition, the H-functions for Euler's anisotropic phase function,

$$P(\cos\Theta) = \varpi_0[1 + x\cos\Theta],$$

ve been determined for $x = -1.0$, (0.2), 1.0 for use in the planet- y problem.

551.521.2 : 523.164 : 621.396.821

THERMAL RADIATION OF THE GROUND AND THE ATMO-HERE AT 1420 Mc/s, AND ITS EFFECT ON AERIAL NOISE. e Abstr. 11722

551.521.3

900. SCATTERING AND POLARIZATION OF LIGHT IN THE MOSPHERE IN THE CONDITIONS OF THE LIBYAN DESERT.
V.Pyaskovskaya-Fesenkova.
kl. Akad. Nauk SSSR, Vol. 123, No. 6, 1006-9 (Dec. 21, 1958). Russian.

The brightness and polarization of a bright day sky was measured in October-November, 1957, at about 20 km south of Aswan, using a visual photometer with a yellow Schott filter and a polaroid (see "Investigations of the scattering of light in terrestrial atmosphere", Academy of Sciences of the U.S.S.R., 1957). The full index curve of polarized light was separated into two components: that of molecular scattering and that of scattering by aerosol particles.

F.Lachman

551.521.3

12901. EFFECT OF OZONE ON THE TOTAL SKY AND GLOBAL RADIATION RECEIVED ON AN HORIZONTAL SURFACE.
J.V.Dave and Z.Sekera.
J. Meteorol., Vol. 16, No. 2, 211-12 (April, 1959).

Making use of Chandrasekhar's theory of atmospheric light scattering, it is shown that computed values of the specific intensity of diffused sky radiation between 2900 A and 40 000 A, which correspond to an atmospheric ozone concentration of 0.5 cm, are in excellent agreement with those observed for a clear atmosphere by Liljequist in Antarctica (1956). D.R.Barber

551.521.6 : 536.3

BACKGROUND NOISE MEASUREMENTS AT THE SEA HORIZON. See Abstr. 12173

551.521.9

12902. SATELLITE-MEASURED RADIATION. G.W.Stuart.
Phys. Rev. Letters, Vol. 2, No. 10, 417-18 (May 15, 1959).

It is pointed out that in the height range 3-6 earth radii the charge-exchange cross-section $H^+ - H$ for protons in the energy range 10-100 keV is high, so that the trapped lifetime of such charges in the earth's field is small. This suggests that the low-energy component of the earth's radiation belt arises from a much more intense source of protons than previously thought, or else that it arises from electrons accelerated from the eV energy range.

G.M.Brown

551.521.9

12903. PROTONS IN THE EARTH'S MAGNETIC FIELD.
S.C.Freden and R.S.White.
Phys. Rev. Letters, Vol. 3, No. 1, 9-11 (July 1, 1959).

A small stack of nuclear emulsions was exposed to the particles in the lower Van Allen radiation belt, and the identity, flux, and energy distribution of those particles, trapped in the earth's magnetic field, have been determined, which penetrate more than 6 g/cm^2 of material. The proton energy spectrum was determined, and although the earth neutron albedo theory can account for the protons observed, neither the spectrum predicted by Singer (Abstr. 1567 of 1958), nor by Hess (following abstract) is as steep as the experimentally obtained distribution. E.W.Kellerman

551.521.9

12904. VAN ALLEN BELT PROTONS FROM COSMIC-RAY NEUTRON LEAKAGE. W.N.Hess.
Phys. Rev. Letters, Vol. 3, No. 1, 11-13 (July 1, 1959).

From the calculation, based on the measured cosmic-ray neutron energy spectrum, of the numbers of neutrons leaking out of the atmosphere, the equilibrium proton energy spectrum in the inner Van Allen belt was calculated. The results agree well with the experimental spectrum found by Freden and White (preceding abstract) from 90 MeV to 200 MeV, but considerably fewer protons above 200 MeV are found experimentally than predicted by this analysis. The possible causes of this difference are discussed.

E.W.Kellermann

551.521.9

12905. THEORY OF THE ORIGIN OF THE VERY LOW-FREQUENCY RADIO EMISSIONS FROM THE EARTH'S EXOSPHERE.
J.W.MacArthur.
Phys. Rev. Letters, Vol. 2, No. 12, 491-2 (June 15, 1959).

A new theory of the dawn chorus is presented, which considers the e.m. waves as being radiated from a rotating cloud of protons, gyrating round the earth's magnetic field. Allowance for the Doppler frequency shift shows that the equations derived by Gallet (Abstr. 7213 of 1959) on the basis of a different theory involving a travelling-wave tube type of interaction can be obtained as limiting cases.

G.M.Brown

551.576

12906. CAPILLARY RELATION BETWEEN TEMPERATURE AND SIZE OF ICE PARTICLES IN CLOUDS. A.S.Skapski.
J. chem. Phys., Vol. 31, No. 2, 573 (Aug., 1959).

The Kelvin-type equation leads to the relation

$$2r = 16 \times 10^{-6} (\Delta T)^{-1} \text{ cm}$$

between the critical diameter (2r) of the ice particles and the undercooling (ΔT). It is shown graphically that both Langmuir's data and Schaefer's experimental results are in agreement with the relation.
S.Weintroub

551.593.12

12907. EXPERIMENTAL INVESTIGATION OF THE STATISTICAL CHARACTER OF THE TWINKLING OF LIGHT ORIGINATING AT THE EARTH'S SURFACE. A.S.Gurvich, V.I.Tatarskii and L.R.Tsvang.
Dokl. Akad. Nauk SSSR, Vol. 123, No. 4, 655-8 (1958). In Russian.
Measurements have been made over paths between 250 and 2000 m and the results correlated with the wind velocity. The results are compared with various theoretical expressions.
J.M.Hough

551.594.12 : 537.56

MICROWAVE CONDUCTIVITY OF SLIGHTLY IONIZED AIR.
See Abstr. 12403

551.594.14

12908. FALLOUT PARTICLES OF HIGH SPECIFIC ACTIVITY. B.Gross, A.Aron, E.Meyer, F.X.Roser, S.Costa Ribeiro and A.C.Olinto.
Acta phys. Austriaca, Vol. 12, No. 2, 187-95 (1958).
Particulate airborne fall-out was measured, using filters exposed in a daily contamination-survey in Rio de Janeiro. On 25 June 1957, a particle of rather uncommon size (r = 4 μ) and activity (5×10^{-9} c) was caught. By applying Way and Wigner's decay-law for fission products, its origin could be traced back to the first British H-bomb test in the Christmas Islands 50 days previously. Analysis of the absorption curve, reduced to parallel beam incidence by means of Gross' transform, and comparison tests with a P^{32} standard, led to a separation into 3 main groups of beta-emitters present. Their energies identify the various fission products making up the activity of the particle. $Ce^{144} \rightarrow Pr^{144}$ and $Sr^{90} \rightarrow Y^{90}$ constitute its near totality. Particle size, shape and activity are given; physical implications, as well as possible biological consequences, are mentioned.

551.594.14

12909. ON THE STRUCTURE OF CERTAIN RADIOACTIVE DUSTS. M.Guillot and A.Delaval.
C.R. Acad. Sci. (Paris), Vol. 249, No. 1, 85-7 (July 6, 1959).
In French.
The possible constituents and structure of the aerosols resulting from natural atmospheric radioactivity and from a nuclear explosion are generally discussed.
G.I.W.Llewelyn

551.594.14

12910. THE NATURAL BACKGROUND DURING MEASUREMENT OF RADIOACTIVE AEROSOLS. C.Jech.
Czech. J. Phys., Vol. 7, No. 1, 34-44 (1957). In Russian.
The average concentrations of natural radioactive substances present in the atmosphere in the form of aerosols were measured by two methods which differ both in the method of collecting the aerosol and in the determination of its radioactivity. In one, the aerosol was collected by drawing air through Whatman filter paper, which was then burned and the beta activity of the ash measured by means of a G.M. counter. In this way, the average activity corresponding to the decay products of radon and thoron collected on the filter for various periods (4 and 8 hr), the form of the disintegration curves and the extent of the fluctuation of this activity with meteorological conditions, were determined. From these measurements the following values were derived for the average concentration of radon and thoron in the atmosphere:

$$C_{Rn} = 0.41 \times 10^{-13} \text{ c/l};$$
$$C_{Tn} = 2.6 \times 10^{-15} \text{ c/l}.$$

It was further ascertained that the slope of the initial part of the disintegration curve (corresponding to the disintegrationof the products of radon) depends on the amount of long-lived radioactive substance collected on the filter; it is shown how the determination of this slope can be used for determining the presence of long-lived substances in the air. In the other method, the aerosol was collected from air by means of an impactor on the surface of a nuclear emulsion and the concentration of radioactive products was determined by counting the tracks of alpha particles recorded in the emulsion. In an emulsion on which the aerosol was collected from 11 litres of air, on the average 30 alpha-tracks were recorded, of which roughly half correspond to the disintegration products of radon and half to the products of thoron. From these measurements the following values were derived for the average concentration of radon and thoron in the atmosphere:

$$C_{Rn} = 0.2 \times 10^{-13} \text{ c/l};$$
$$C_{Tn} = 1.7 \times 10^{-15} \text{ c/l}.$$

During 1-4 March 1955, the presence was determined of a weak concentration of long-lived activity, probably fission products originating from the nuclear explosion which took place at the end of February in Nevada.

551.594.

12911. INCREASE OF C^{14} IN THE ATMOSPHERE FROM ARTIFICIAL SOURCES MEASURED IN A CALIFORNIA TREE. G.S.Bien and H.E.Suess.
Z. Phys., Vol. 154, No. 2, 172-4 (1959).
The wood examined was from a pine tree grown in an area essentially free of industrial CO_2. Lignite was separated from rin of the tree. CO_2 was produced from this and its C^{14} activity meas and normalized to the same C^{13} concentration.
D.H Lo.

551.594.5 : 550.3

12912. TIME VARIATION OF THE INTENSITY OF AURORAL HYDROGEN EMISSION AND THE MAGNETIC DISTURBANCE. C.Y.Fan.
Astrophys. J., Vol. 128, No. 2, 420-7 (Sept., 1958).
The time variation in the intensity of auroral hydrogen emiss and the magnetic disturbance were simultaneously recorded for a number of cases. It was found that the horizontal component of th terrestrial magnetic field increases prior to the appearance of an auroral arc and that the onset of a negative bay in the disturbance coincides with the break-up of the arc to rays and an abrupt decrease in the intensity of the hydrogen emission. These observations suggest that there are two current systems — one responsib for the acceleration of auroral protons and electrons for the excit tion of auroral arcs and the other for the acceleration of auroral electrons for the excitation of auroral displays of more active typ

551.594

12913. ORIGIN OF [OI] 5577 IN THE AIRGLOW AND THE AURO F.E.Roach, J.M.McCaulley and E.Marovich.
J. Res. Nat. Bur. Stand., Vol. 63D, No. 1, 15-18 (July-Aug., 1959).
The distribution of 5577 zenith intensities at stations in the subauroral zone is found to be unimodal with no discontinuity at th visual threshold. This is interpreted as evidence that 5577 airglo and 5577 aurora may have a common origin.

551.594

12914. COMPARISON OF ABSOLUTE INTENSITIES OF [OI] 5577 IN THE AURORAL AND SUBAURORAL ZONES. F.E.Roach, J.W.McCaulley and C.M.Purdy.
J. Res. Nat. Bur. Stand., Vol. 63D, No. 1, 19-20 (July-Aug., 1959).
The distribution of 5577 zenith intensities is compared for Fritz Peak, Colorado, in the subauroral zone and Thule, Greenlan near the geomagnetic pole. The absolute intensity is bright enoug to permit visual detection at the Colorado station during 2 percent the time and at the Greenland station, 27 percent of the time. The distribution curves have a general similarity, suggesting a phenom enological similarity in the excitation mechanisms at the two stations.

551.594.51 : 537.591

12915. ON A POSSIBLE VELOCITY DISPERSION OF AURORAL PROTONS. J.W.Chamberlain.
Astrophys. J., Vol. 126, No. 2, 245-52 (Sept., 1957).
The possibility was investigated of a dispersion in velocities the protons that are incident on the atmosphere during auroral arc A velocity spread in the incident flux of particles varying approximately as v^{-2} could give a consistent explanation to the luminosity curves and hydrogen-line profiles. The angular dispersion is pro ably proportional to $\cos^2 \theta$. There seems to be no way to explain the observations with mono-energetic particles. The data are ina quate to show whether protons alone are the cause of auroral arcs or whether additional processes (e.g. fast incident electrons, elec tric fields) need to invoked. The implications of a velocity disper sion are discussed, insofar as a theory of primary auroral partic is concerned. It appears that an acceleration mechanism close to the earth is required.

551.594.51

6. DISTRIBUTION OF ENERGY IN THE SPECTRA OF ORA BOREALIS IN THE REGION 3900-8700 A. I.G.Frishman. ka i Spektrosk., Vol. 6, No. 3, 323-8 (March, 1959). In Russian. Reports the results of photoelectric measurements of the absoluminance (brightness) of aurora borealis in the 3900-8700 A on, carried out in 1954-7 at Murmansk. These measurements used to obtain the energy distributions in the spectra of aurora alis of various forms. All results were corrected for absorption e terrestrial atmosphere. A.Tybulewicz

551.594.51 : 537.591.15

SOLAR PROTON STREAM FORMS WITH A LABORATORY EL. See Abstr. 12426

551.594.6

7. RECORDING OF THE MEAN SQUARE VALUE OF ATMOSRIC NOISE. F.Carbenay.
Acad. Sci. (Paris), Vol. 249, No. 1, 67-8 (July 6, 1959).
ench.
Description of the apparatus used by C.N.E.T. for recording atmospheric noise. The device employs thermocouples, and the square of the strength of the current produced by noise of a given frequency is recorded photographically from galvanometers after amplification. G.M.Brown

551.596.1

12918. ATMOSPHERIC PROPAGATION OF POWERFUL ACOUSTIC SIGNALS OVER GREAT DISTANCES. Y.Rocard. C.R. Acad. Sci. (Paris), Vol. 248, No. 22, 3131-2 (June 1, 1959). In French.

An extension of previous work (Abstr. 4157 of 1959) to explain, for sound from nuclear explosions, the propagation over 400 km even with unfavourable wind and temperature distributions. The importance of size of explosion is emphasized. H.D.Parbrook

551.74 : 532.65

POWER-LAW FOR THE SIZE DISTRIBUTION OF SMALL PARTICLES OR DROPS FALLING THROUGH THE ATMOSPHERE. See Abstr. 11891

BIOPHYSICS
PHYSIOLOGICAL PHYSICS

612.2

9. CARBON-14 RESPIRATION PATTERN ANALYZER FOR ICAL STUDIES. B.M.Tolbert, M.Kirk and F.Upham.
sci. Instrum., Vol. 30, No. 2, 116-20 (Feb., 1959).
A description of an instrument for measuring C^{14}, percent CO_2, C^{14} specific activity in the breath of human subjects is pres-. Ionization chamber assay for the C^{14} is used. The design meters of radioactivity sensitivity and response time are dised. For simple carbon-14 metabolites, some 1 to 10 μC are red for an eight-hour respiration analysis with this instrument.

612.843

0. SOME COMPARISONS BETWEEN FOVEAL SPECTRAL SITIVITY DATA OBTAINED AT HIGH BRIGHTNESS AND OLUTE THRESHOLD. H.G.Sperling and W.G.Lewis.
pt. Soc. Amer., Vol. 49, No. 10, 983-9 (Oct., 1959).
The spectral sensitivity of the fovea was measured by three hods on the same three observers. The methods were: absolute shold with two sizes of stimuli, flicker photometry, and heteromatic brightness matching. The data were analysed with reference to (a) the reliability of the departures from a smooth curve, he presence of a scotopic factor within a 2^0 centrally-fixated field, c) the additivity of heterochromatic luminances as determined by CIE procedure. The results indicate (1) good correspondence of e major irregularities at 450-60, 490. and 580 mμ, (2) definite scotopic components in the 2^0 data and possible scotopic effects in the 45' data, (3) for the 45' absolute threshold the irregularity at 580 mμ consistently became a sharp loss in sensitivity which delineated twin peaks at 540 and 590-600 mμ. The threshold data showed a very large failure of additivity of luminances over this same region of the spectrum.

612.843

12921. . A METHOD OF DETERMINING SPECTRAL COLOUR COORDINATES. N.I.Speranskaya.
Optika i Spektrosk., Vol. 4, No. 1, 87-90 (Jan., 1958). In Russian. English summary: PB 141047T-3, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington,D.C., U.S.A.

Comparisons of colour coordinate assessment using different fields of vision 2^0, 10^0 and 10^0 with a 2^0 blackout diaphragm in the centre. The results show systematic differences between the 2^0 field and either of the 10^0 fields but little difference between the latter two fields. The 10^0 fields give smaller errors both for one observer and between different observers. Comparison of 2^0 field results with those of a 2^0 field for a standard C.I.E. observer shows a deviation for "blue" curves. 10^0 field comparisons show even bigger differences for "blue" curves which might indicate inaccuracies in the C.I.E. values. The central 2^0 diaphragm in the 10^0 field reduces the effect of the "Maxwell spot" on the retina.
G.F.J.Garlick

TECHNIQUE . MATERIALS

PHOTOGRAPHY

77 : 551.521

ILLUMINATION CONDITIONS ON A FIXED, INCLINED SURFACE FACING SOUTH UNDER A CLEAR SKY. See Abstr. 12898

77.01 : 539.2

PHOTOCHEMICAL REACTIONS IN SILVER HALIDE CRYSTALS. See Abstr. 12788

771.531

12922. SULPHUR SENSITIZATION OF SILVER BROMIDE EMULSIONS. A.Hautot.
"Particle photography" conference, Strasbourg, 1957 (see Abstr. 11704 of 1959) pp. 45-53. In French.

The sensitizing action obtained by the addition of sulphur in compound form or by suitable ripening of the emulsion, is described. A three-stage mechanism is proposed based on the dynamic equilibrium of sulphate-silver-bromide complexes and the preferential accumulation of sulphate ions in the surface planes of the microcrystals. S.J.St-Lorant

771.531 : 537.533

12923. THE ACTION OF ELECTRONS ON EMULSION PLATES. H.Frieser.
"Particle photography" conference, Strasbourg, 1957 (see Abstr. 11704 of 1959) pp. 55-69. In French.

Several types of emulsion with commercial and experimental compositions are exposed to the beam of an electron microscope. Three methods are used in the analysis of the grain structure: measurement of the Callier coefficient and calculation of the granulation, estimation of the mean fluctuations in density and reconstruction of the grain distribution from the noise spectrum of a photoelectric densitometer. It is found that the grain density increases with the amount of received radiation to the maximum capacity of the emulsion. The electron sensitivity is proportional to the silver bromide concentration and appears to increase with the grain size, this enhancement being dependent on the energy of the incident electrons. S.J.St-Lorant

771.531

12924. THE INFLUENCE OF $S^{=}$ IONS ON THE RECIPROCITY FAILURE OF THE SURFACE IMAGE AT VERY SHORT EXPOSURES. H.Sauvenier.
"Particle photography" conference, Strasbourg, 1957 (see Abstr. 11704 of 1959) pp. 85-92. In French.

The disappearance of reciprocity failure for intense exposures is studied as a function of the composition of the emulsion and the duration and intensity of the incident light. The effect of adequate maturation of the emulsion and the addition of a number of sensitizing agents is described. It is concluded that small admixtures of sulphate-ion containing agents during maturation stabilize the number of active grains and prevent clumping. S.J.St-Lorant

771.531 : 535.33

12925. PHOTOGRAPHIC PLATES FOR THE VACUUM-ULTRAVIOLET SPECTRAL REGION. I.R.Protas.
Optika i Spektrosk., Vol. 4, No. 6, 803-5 (June, 1958). In Russian. English summary: PB 141041T-11, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington,D.C., U.S.A.

The author describes a technique for the preparation of photographic plates with a low gelatine content which are 4-5 times more sensitive at 1402 A than Schumann plates and also possess higher contrast and resolving power. R.D.Hudson

771.534

12926. PHOTOGRAPHIC SENSITIVITY. J.W.Mitchell.
"Particle photography" conference, Strasbourg, 1957 (see Abstr. 11704 of 1959) pp. 13-44. In French.

A survey article dealing with the major aspects of the problems involved in the formation and development of the latent image. T Gurney–Mott theory of image formation is replaced by the more recent concept of centres of sensitivity. Such centres are though to be associated with an increased surface activity at points of emergence of internal imperfections, dislocations in particular. The detailed implications of such a hypothesis are discussed and their general applicability illustrated. The processes of sensitiz tion by various agents are investigated. The physico-chemical principles of the development of the latent image, and the nature the changes involved in the process under given conditions receiv detailed attention. S.J.St-Lor

771.534 : 537.312

12927. THE SPECTRAL SENSITIVITY OF PHOTOGRAPHIC FILMS. J.Eggert.
Ann. Phys. (Leipzig), Folge 7, Vol. 4, No. 1-5, 140-4 (1959). In German.

The spectral sensitivity of AgBr films is explained in terms lattice disturbances, and the sensitivity above 4900 A is shown to depend upon the number of imperfections present. Sensitization b dyes is also considered. The performance of an AgBr photocell i shown to exhibit the same spectral effects as photographic films. R.W.F

771.5

12928. THEORY OF THE FORMATION OF THE LATENT ELECTROPHOTOGRAPHIC IMAGE AND THE LAW OF MUTUAL SUBSTITUTION. V.M.Fridkin.
Dokl. Akad. Nauk SSSR, Vol. 121, No. 4, 627-30 (1958). In Russia

The problem is formulated and discussed in terms of the transition of electrons between levels in the normal, the conducti and the attachment zones. See also Abstr. 12226.

R.F.S.Hearm

778.33 : 535.

12929. THE COMPARATIVE MERITS OF DIFFERENT METHO OF MICRORADIOGRAPHY. V.E.Cosslett.
Appl. sci. Res. B, Vol. 7, No. 5, 338–42 (1959).

In comparing the speeds of the various microradiographic methods, it has been usual to take as basis the exposure time nee for recording the X-ray image. It is more realistic to include th time required to make available the information stored in the negative by producing an image magnified up to the resolution of the eye. From this point of view the projection method is much faster than the times-two method or contact microradiography, fo a given field of view, i.e. they stand in reverse order to that of their initial exposure times. In given camera length, on the other hand, the initial exposure is the same for both projection and contact, and is much longer for the times-two method. But the overall time for production of the final image is now much the same for all three methods. As regards resolution, the projectio method offers the best ultimate performance.

778.33 : 535.

12930. COMMENTS ON V.E.COSSLETT: THE COMPARATIVE MERITS OF DIFFERENT METHODS OF MICRORADIOGRAPHY. Ong Sing Poen and J.B.Le Poole.
Appl. sci. Res. B, Vol. 7, No. 5, 343-4 (1959).

A reply to the preceding abstract. As regards the time facto it is maintained that the exposure time is the most important quantity in most microradiographical problems. As regards resolving power, the formation of Fresnel fringes is not a limiting factor within the claimed limiting resolution of the 2× method (0.3 - 0.5 μ). The resolution of the projection method is admitte better, but the main reason for introducing the 2× method was no to increase intensity at high resolution. It was to show that a gai a factor of 2 in resolution over the contact method was practicall realizable, contrary to the views of Haine and Mulvey (Abstr. 88 of 1953). Nevertheless, the 2× method gives also an important ga in intensity at moderate resolution. V.E.Coss

LIST OF JOURNALS

The following list supplements the List of Journals published with the index to Volume 61 (1958). Reprints of the List of Journals can obtained from The Institution of Electrical Engineers, Savoy Place, London, W.C.2, price 2s.0d. post free.
The addresses given are believed to be correct at the date of publication, but no responsibility can be accepted for errors.

.T.M. Bull.	American Society for Testing Materials. Bulletin. 1916 Race Street, Philadelphia, Pa.
l. Kyushu Inst. Technol. th. nat. Sci.).	Bulletin of the Kyushu Institute of Technology (Mathematics, Natural Science). Tobata, Japan.
ien.-fiz. Zh.	Inzhenerno-fizicheskii Zhurnal. Izdatel'stvo Akademii Nauk, Prospekt Stalina 108, Minsk, B.S.S.R.
. Ionosphere Space Res. Japan	Report of Ionosphere and Space Research in Japan. Science Council of Japan, Ueno Park, Tokyo. [Formerly: Report of Ionosphere Research in Japan (Rep. Ionosphere Res. Japan)].
Record	Science Record. Academia Sinica. Publishers: Science Press, Peking. Subscription address: Guozi Shudian, 38 Suchou Hutung, Peking.
s. Z. Hochsch. Maschinenbau l-Marx-Stadt.	Wissenschaftliche Zeitschrift der Hochschule für Maschinenbau Karl-Marx-Stadt. Karl-Marx-Stadt, Germany.
	CHANGE OF TITLE
. Ionosphere Res. Japan	Report of Ionosphere Research in Japan. Title changed to: Report of Ionosphere and Space Research in Japan [Rep. Ionosphere Space Res. Japan] with the issue dated March 1959.

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Slope Resistance at 25°C Max. Limit	20 ohms	19 ohms	18 ohms	17 ohms	12 ohms	10 ohms
Slope Resistance at 25°C Min. Limit	15 ohms	14 ohms	12 ohms	12 ohms	6 ohms	5 ohms
TYPE	VR575B-B	VR625-B	VR7-B	VR8-B	VR9-B	VR10-B
Voltage Range	5·4–6·1	5·9–6·6	6·4–7·6	7·4–8·6	8·4–9·6	9·4–10·6
Slope Resistance at 25°C Max. Limit	5 ohms	4 ohms	4 ohms	4 ohms	4 ohms	5 ohms
Slope Resistance at 25°C Min. Limit	0	0	0	0	0	0

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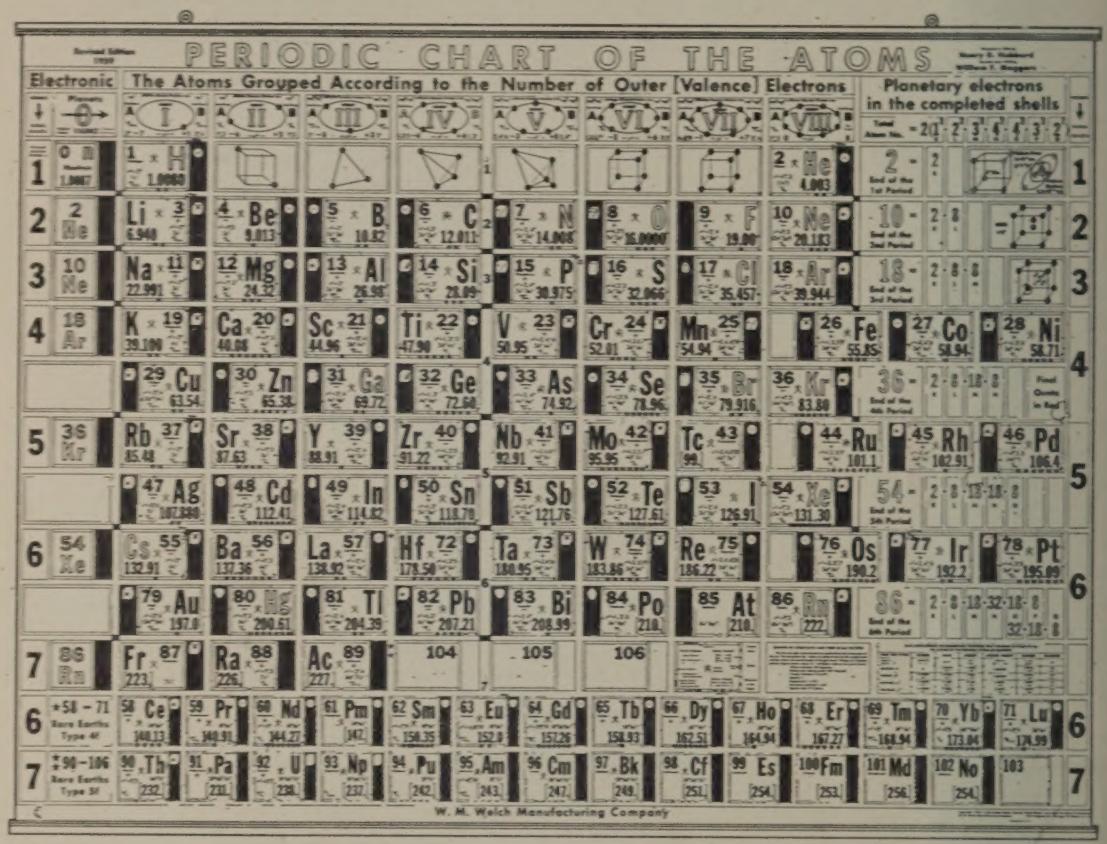
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